THE TELEGRAPHIC JOURNAL AND

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THE RESISTANCE OF CARBON AND THE TELEPHONE.

It is a little curious that all through the telephone controversy during the past four or five years, and also in the recent lawsuits of Edinburgh and London, no mention has been made, as far as we are aware, of the experiments made as long since as 1866 by Mr. S. Alfred Varley with carbon lightning guards. It is well known that this gentleman has claims jointly with Sir Charles Wheatstone and Dr. Siemens to the discovery of the reaction principle upon which the dynamo-electric machines of the present day are constructed. In 1870 Mr. Varley read an important paper before Section A of the British Association meeting at Liverpool on "Lightning and Telegraph Wires," and this was published in our contemporary *Engineering* on the 7th of October in that year.

Mr. Varley, when experimenting with electric currents of varying degrees of tension, had observed the very great resistance which a loose mass of dust composed even of conducting matter will oppose to electric currents of moderate tension.

With a tension of, say, fifty Daniell cells, no appreciable quantity will pass across the dust of blacklead or fine charcoal powder loosely arranged, even when the battery poles are approached very near to one another.

If the tension be increased to, say, two or three hundred cells, the particles arrange themselves by electrical attraction close to one another, making good electrical contact, and forming a channel or bridge through which the electric current freely passes.

When the tension was still further increased to six or seven hundred cells the author found the electricity would pass from one pole to the other through a considerable interval of the ordinary dust which we get in our rooms, and which is chiefly composed of minute particles of silica and alumina mixed with more or less carbonaceous and earthy matters. Incandescent matter offers a very free passage to electrical discharge, as is indicated by the following experiments. The author placed masses of powdered blacklead and powdered wood charcoal into two small crucibles ; no current would pass through these masses of powder whilst they were cold, however close the poles were approached, without actually touching. The battery employed in this experiment was only twelve cells.

The crucibles were then heated to a red heat, and electricity freely passed through the heated powder, and on testing the resistance opposed by the heated particles, placing the poles 1 in. apart, and employing only six cells, the average resistance opposed by the blacklead was only four British Association units, and that opposed by the wood charcoal five units.

These observations go to show that an interval of dust separating two metallic conductors opposes practically a decreasing resistance to an increasing electrical tension. Reasoning upon these data the author was led to construct what he terms a "lightning bridge," which he constructs in the following way :—

Two thick metal conductors, terminating in points, are inserted usually in a piece of wood. These points approach one another within about 1-18th of an inch in a chamber cut in the middle of the wood.

This bridge is placed in the electric circuit in the most direct course which the lightning can take, and the space separating the two points is filled loosely with powder, which is placed in the chamber, and surrounds and covers the extremities of the pointed conductors.

The powder employed consists of carbon (a conductor), and a non-conducting substance in a minute state of division.

We have now to consider the behaviour of the lightning bridge in a circuit struck by lightning.

The lightning finds in its direct path, not a space of air, but a bridge of powder, consisting of particles of conducting matter in close proximity to one another ; it connects these under the influence of the discharge, and throws the particles into a highly incandescent state. Incandescent matter offers a very free passage to electricity, and the secondary current developed by the demagnetisation finds an easier passage across the heated matter than through the coils of a telegraph instrument.

The reason a powder consisting entirely or chiefly of conducting matter cannot be safely employed, is that, although in the ordinary conditions of things it would be found to oppose a practically infinite resistance to the passage of electricity of the tension of ordinary working currents when a high tension discharge occurs, the particles under the influence of the discharge will generally be found to arrange themselves so closely as to make a conducting connection between the two points of the lightning bridge. This can be experimentally demonstrated by allowing the secondary currents developed by a Rhumkorff's coil to spark through a loose mass of blacklead.

Mr. Varley made the following experiments to test the resistance opposed to the passage of electricity by powdered conducting matter :—

Two crucibles were filled with blacklead powder (the best commercial blacklead used for domestic purposes). Two crucibles were filled with powdered charcoal, obtained from a charcoal dealer. The battery poles of a 12-cell sulphate battery were placed half an inch apart in the powders, a horizontal galvanometer being included in the circuit, and no deflection was obtained either with the blacklead or the charcoal powder ; the galvanometer employed gave a deflection of 50 deg. with 12 cells through a resistance of 65,000 ohms. The crucibles were then heated to a full red heat, and the poles of the 12-cell battery placed in the heated powder, and the resistance opposed by the heated powder in each crucible measured. The wood charcoal gave a resistance never exceeding 7 ohms. The blacklead gave a resistance never exceeding 6 ohms. The crucibles were then removed from the fire and allowed to cool, and tested again some days afterwards ; the powders were now found to conduct when cold. The wood charcoal powder gave a resistance continually varying and ranging between 2,000 and 500

ohms. The blacklead gave a more constant resistance, ranging between 400 and 100 ohms.

Mr. Varley concluded from this that the effect of highly heating charcoal and blacklead appears to be to make the particles more dense and to bring them closer together, so that they conduct.

It seems highly probable that had Mr. Varley been engaged as a scientific witness in the late trials, some very interesting information concerning the behaviour of carbon in different forms under various conditions might have been elicited, as it is hardly probable that his experiments did not lead him to think of it in connection with matters other than that of his lightning bridge.

A great deal has been said about Clerac's tube of carbon for obtaining variable resistance, and we believe that it was in use before Mr. Varley's invention; still, we think that in justice to the researches of the latter, we should not allow the matter to be unheralded because at the time it formed the subject of no particular praise or called for much remark in scientific journals.

THE TELEPHONE INDUSTRY.

Mr. Fawcett, speaking in the House of Commons last Saturday, said:—"It was desirable also that he should remove all doubt as to the relations of the Government to the telephone companies, as there had been a great deal of speculation on the chance that the Government would purchase them. It was as well that the truth should be known, for he believed that it was altogether improbable that the Government would do so. Their policy was to encourage free competition. If the thing could be done best by private companies he could only say he should be delighted to see the whole telephone business of the country conducted by private enterprise. If, on the other hand, it was proved that the business was better done by the Government, the Government would have beaten the companies in the open field of competition, and could occupy the ground without being subject to claims for compensation."

We are pleased at the attitude taken by the Postmaster-General in this most important matter, and if the private companies can only have fair play, we may shortly hope to see an immense development of such a necessary adjunct to our business relations as the telephone. There are, however, several obstacles to be overcome, the chief one being the monopoly at present possessed by the United Telephone Company—at least in their own ideas. Even here the stumbling-block appears to be not so much in the receiving instrument as in the transmitter. A great difference of opinion still exists as to the amount of ground covered by Mr. Edison's single claim, and yet another battle must be fought over this subject. As far as we understand this Edison patent for a transmitter or tension regulator, it is limited in its character; but we believe that the United Telephone Company think it covers any semi-conductor placed in between any two points of a circuit, no matter how connected, or how constructed, as long as the impulses of the voice are directly employed to change the positions of the atoms composing the semi-conductor, and thus to vary the resistance of the circuit. This unsatisfactory state of affairs will, however, it is to be hoped, shortly be placed on a proper footing; for until such is the case, it is almost hopeless to suppose that the telephonic industry can make any great advance, even on the strength of the licences recently granted by the Postal authorities.

The telephone is no longer a novelty, yet we think our readers will be somewhat surprised at the table we now place before them.

We extract from the New York *Review of the Telegraph and Telephone* of July 15th, the following statistics of the progress made in seven countries of Europe. Number of telephonic subscribers in actual operation in Europe:—

IN FRANCE.

Name of Town.	Name of Corporation or Co.	No. of Subs.
Paris	Société Générale des Téléphones	1,780
Bordeaux	" "	178
Havre	" "	114
Lille	" "	26
Lyons	" "	269
Marseilles	" "	175
Nantes	" "	78

IN ENGLAND.

London	United Telephone Company	1,561
Manchester	Lancashire & Cheshire Telephone Co.	650
Liverpool	" " "	510
Barrow	" " "	19
Preston	" " "	17
Blackburn	" " "	52
Burnley	" " "	33
Wigan	" " "	18
Accrington	" " "	26
Warrington	" " "	12

IN AUSTRIA.

Vienna	334

IN SWITZERLAND.

Zurich	Zurcher-Telephon-Gesellschaft	378
Basle	Gouvernement fédéral	235
Berne	" "	157

IN BELGIUM.

Brussels	Company Belge du Téléphone Bell	402
Antwerp	" " "	651
Liége	" " "	329
Verviers	" " "	189
Charleroi	" " "	200
Ghent	" " "	190

IN ITALY.

Turin	Société Générale Italienne des Téléphones	310
Genoa	" " "	348
Sampierdarna	" " "	30
Milan	" " "	244
Venice	" " "	68
Florence	" " "	65
Livorne	" " "	54
Bologne	" " "	83
Rome	" " "	389
Naples	" " "	182
Palermo	" " "	90
Messini	" " "	17
Catane	" " "	10

IN GERMANY.

Operated entirely by the Government.*

Berlin	" " "	581
Breslin	" " "	63
Cologne	" " "	81
Elberfeld	" " "	11
Frankfort	" " "	179
Hamburg	" " "	606
Leipsic	" " "	142
Madgebourg	" " "	48
Mannheim	" " "	139
Mulhouse	" " "	100
Stettin	" " "	Don't know
Strassburg	" " "	"

As the above statistics stand it would appear that private companies, and not the government, should have the telephone business; but as yet so little has been done in Europe that the data we have at command is scarcely sufficient to allow of the deduction of any decided opinions.

We will now leave our readers to compare the respective telephonic industries of these countries, and we shall look forward to the time when we are able to state that England holds the leading position in this branch of electrical work, which she does at the present moment in regard to the telegraph.

* Price of each subscription is same in every town, viz.: 200 marks (50 dollars), up to 2 kilometres and 50 marks (10 dols.) for each additional kilometre from the Central Bureau. To have a second or additional instrument in the same house and on the second line, the price is an extra 50 marks (10 dols.).

An income of 403,853,474 dols. during the year ending with June, 1882, was more than the government has received during any previous year since 1867, and the cost of the government, including pensions, was but 187,630,093 dols., leaving a surplus of 144,966,937 dols. after the payment of 75,258,439 dols. interest on the national debt. Unfortunately, the pension payment will be very heavy this year; but the interest on the debt will be 13,896,329 dols. less than it was last year. The customs receipts, the greatest last year in all the history of the nation, 219,986,223 dols., would be sufficient to maintain the government and slowly reduce the national debt, were the internal revenue and income from miscellaneous sources wholly to cease.

THE EDISON ELECTRICAL ESTABLISHMENT AT IVRY.

[We are again indebted to the courtesy of M. le Comte du Moncel for advanced proofs of the above interesting article, which appears in our contemporary *La Lumière Electrique*. Unfortunately it arrived too late for insertion in our last week's issue.]

The finest electrical establishment at present in existence in France, both as regards the size of the building and the plant, is that which has just been started at Ivry, near Paris, by the Edison Light Company. It belonged formerly to M. Alexandre, and was used for the construction of organs and pianos, and it is built in a part of the old park of Ivry. Besides the principal part of this establishment, which forms a large courtyard built in on every side, there are several wings of four storeys placed parallel and perpendicularly all round, which give to the whole the appearance of an admirably planned manufacturing city on a small scale. It is in these wings that the various machines are placed which are required for the manufacture of the apparatus which enters into Edison's system of electric lighting.

In one wing we find the lathes and tools necessary for the construction of the dynamo-electric machines of the Edison system. Several models are constructed which can individually maintain series of 17, 60, 100, 125, 150, 250, 500, and 1,200 lamps. Each part of these machines is manufactured in a certain workshop, and the coiling of the wires which necessitated special arrangements is performed in separate rooms.

In several other wings are the workshops devoted to the manufacture of the lamps. In one we see little blades of bamboo which come from Japan in boxes, and then pass through several hands to be reduced gradually to the required thickness, which is that of a sheet of paper, and at last cut so as to present the appearance of a slender filament, perfectly formed and terminated at the two extremities by a sort of expansion, by means of which it is fixed to the wires of the circuit. These different operations necessitate several workmen, who pass to each other in succession the blades of bamboo as they are fashioned, and the work is performed with machines admirably constructed and convenient to manage. In another part of the establishment the carbonisation of the filaments is performed. They are first put into little flat moulds, hermetically closed, which bend them into the shape of a horseshoe; and these moulds are so arranged, that during the carbonisation, which necessarily reduces the length and thickness of the filament, the horseshoe shape is constantly maintained. These moulds are then placed in graphite cases, hermetically closed, and these cases are in their turn put into furnaces heated to a high temperature. An entire building is set apart for this process, and the furnaces are constructed on an excellent model and simplify the work considerably.

The glass bulbs of these kinds of lamps are made in another part of the establishment, and their manufacture is effected in two different workshops. In one are constructed the glass tubes through which the platinum wires are fuzed, to which the extremities of the carbon filaments are to be attached; in the other are manufactured the bulbs into which these tubes are to be introduced with their carbon, and which are to be exhausted of air. It is curious to see with what promptitude these various operations are effected; and one can now easily understand that 500 of these lamps can be made in a day.

But what especially excited my curiosity is the manner in which the vacuum is obtained; it is quite an installation of a physical laboratory. Imagine in a large hall a sort of long enclosure, closed by three partitions about 2 metres high, and on the walls of which are externally placed in series 500 mercury barometer tubes, of a construction somewhat analogous to that employed by Sprengel; imagine adjusted to each of these tubes a lamp with its bulb not yet closed, and in the middle of the space enclosed by the partitions two large tubes of cast-iron, about 20 centimetres in diameter, communicating with the 500 tubes and connected with an enormous vacuum pump of Sprengel, and you will be able to form an idea of the importance which has been given to this process. The process of exhausting these lamps is, as has been often said, extremely important and very delicate; for not only should the vacuum prevent the combustion of the carbon filament, but it should also increase its tenacity. This is why it is necessary to proceed by several successive operations effected after longer or shorter intervals of time, during which the filament is rendered incandescent under the influence of a more or less powerful current. Thus the gases contained in the pores of the carbon are set free, its density increases, and its tenacity becomes sufficiently great to be comparable to that of a metallic wire.

Under these conditions filaments of carbon of the thinness of a hair can resist powerful jerks communicated to the lamp, and are not appreciably changed by incandescence. It is by this means that the lamps now used in the Edison system are warranted by the company to last 800 hours. There are besides many which have lasted nearly double that time, and it is even asserted that the mean duration is 1,200 hours.

One of the most important conditions of the Edison system is the complete uniformity of resistance of the carbonised filaments; therefore an entire testing apparatus has been arranged for the measurement of this resistance by the Wheatstone bridge and the Thomson mirror galvanometer. A dark room is used for this purpose, and as the filaments are manufactured, they are sent to the operator and classified according to their resistance. The carbons of the 16 candle-power lamps have a resistance of about 140 and those of the 8-candle lamps a resistance of 70 ohms. However, some are now constructed which have a resistance of 280 ohms, and which are made to give a light of 10 candles.

These carbons have the advantage of allowing of a greater division of the light from the same dynamo-electric machine, and this can be easily understood if we reflect that the total resistance of the outer circuit, which should be about equal to that of the machine, would become much less than the latter, if the number of derivations became too great, and in order then to obtain the equality of the two resistances, the resistance of each derivation must be increased. The measurement of the resistance of the carbons is not all that is done in the hall of which we are now speaking; the photometric measurement of each lamp, under the influence of a given and constant current, is also taken. For this purpose the Bunsen photometer is used, and for a standard light, a Carcel lamp, arranged on a balance, is employed, so that the quantity of oil consumed per hour can be measured. All these measurements are noted, and the lamps are grouped into different divisions, according to their resistance and intended luminous intensity.

Other workshops are also set apart for the joining of the carbon filaments to the platinum conductors, and for mounting the lamps on their supports. We know that the platinum wires are terminated where they meet the carbon by two little plates, arranged like the jaws of a vice, and between these plates are introduced the appendages which terminate the filament. In order to insure good contact, they are electro-coppered, and the joint becomes permanent. For this purpose several baths are placed separately in a room, and in each bath a great number of these joints can be coppered simultaneously. The plaster mounting of the bulbs on to their support is also done quickly and very simply, so that all the elements which enter into the construction of the Edison lamps are manufactured in the establishment. Only the fittings, suspensions, brackets, and candelabra of bronze, are left to Parisian industry, but they are constructed according to the models sent from America.

Besides the workshops of which we have just spoken, there are others set apart for the manufacture of the conductors, of different diameters, intended to supply electricity to the lamps through streets and houses. This department has only just started, and has not as yet the importance that it will have in the future; but it has necessitated a vast amount of space, and several buildings adjacent to the establishment will be employed for this work. We must also mention among the various departments of this industry, the rooms for designs of machines and of installations, rooms for packing, saw-mills, forges, and experimenting rooms, in which are placed steam-engines of great power.

The whole installation has been effected in six months, under the able direction of Mr. Batchelor, Mr. Edison's collaborateur, who is the engineering electrician to the com-

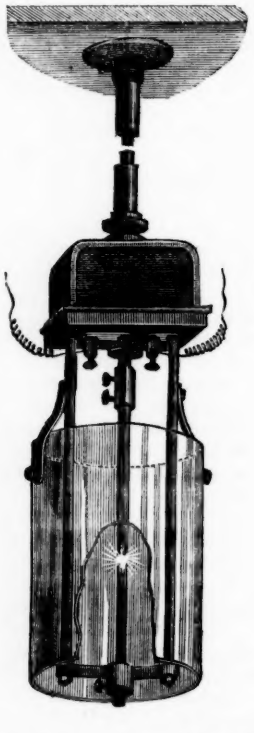
pany. It will not, however, be completed until the latter end of the year. We see that, unlike what has been done by many electric lighting companies, the one of which we speak is more interested in the practical side of the question than the financial, which is a safe guarantee of the reliability of the enterprise. Besides, it is known that already several installations have been established in various European towns, and we know that the company is receiving every day orders for France. As they are now in a position to carry them out, it is probable that we shall very shortly be able to judge for ourselves of the advantages of this system of lighting.

TH. DU MONCEL.

ELECTRIC LAMP.

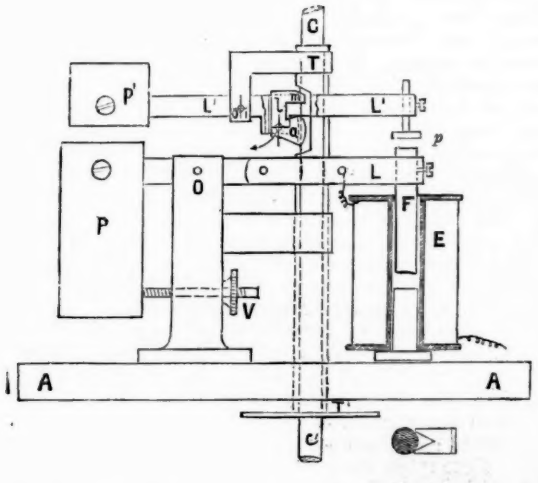
ROBERT MONDOS' SYSTEM.

This electric lamp has lighted the concert-hall of the Champs Elysées since the 1st May last, and an indefinite number of burners can be placed in one circuit, according to the electromotive force of the generating machine. The regulation is founded on the principle of derivation, the inventor having determined to dispense with all clockwork and all antagonistic springs, and has so arranged his apparatus that a single electro-magnet performs the two distinct functions of making and regulating the arc. The lower carbon is fixed on a strap suspended to the box containing the mechanism, the displacements of the movable upper carbon effect the lighting and maintain the fixity of



the arc. The mechanism represented in the diagram comprises an electro-magnet, E, the cores of which only occupy part of its length, about one-third; inside the coils, two rods of soft iron, F, suspended to a horizontal lever, L, turning at O and balanced by a weight, P, move freely. The screw, V, serves to limit the movement of the lever, L, to which is suspended a tube, T T′, traversed by a solid rod, C C′, which supports the movable carbon suspended to its lower extremity. The carbon holding rod, C C′, can slide freely into the tube, T T′, but it is prevented from doing so by a brake, *m*, *l*, *a*, the two extremities of which, *m* and *a*, in the form of a V, grip the rod, C C′, and hold it by friction in the tube, T T′. For this purpose, the tube, T T′, has an indentation opposite the brake. This brake is fixed on a lever, L′, L′, turning at the point, O′. The movements of the centre, O′, are distinct from those of the tube, T T′, on account of the square, T O′; the lever, L′, has an armature of soft iron, *p*, placed opposite the cores, F, and the action which the cores tend to exercise on this armature is counter-balanced by the weight, P′. When the apparatus is at rest the carbons are separated and the brake, *l*, *m*, *a*, maintains the rod, C C′, firmly held in the tube, T T′.

At the time when the current is sent into the apparatus, the carbons being separated, the current passes entirely into the coils, E, the rods, F, are powerfully attracted, the lever, L, swings and makes the entire system descend, whereas the armature, *p*, being powerfully attracted, loosens the brake and enables the rod, C C′, to descend freely until the two carbons come in contact. At this moment, the carbons being in contact, the current passes almost entirely through the main circuit, the power of the electro-magnet diminishes considerably; the levers, L and L′, then swing in an opposite direction under the action of the weights, P and P′, the entire system is raised and the arc is formed. As the arc lengthens in consequence of the consumption of the carbons, the current which passes through E increases in power, the cores, F, are more powerfully attracted, they attract the armature, *p*, with more force; the lever, L′, then tends to swing in the direction of the hands of a watch, the point of attachment of the brake, *l*, *m*, *a*, tends to recede from the rod, C C′, and consequently to loosen the brake which allows the rod to slide, and so shortens the arc. Practically the movement of L′ is inappreciable, and the rod, C C, slides by its own weight slowly and continuously. During this process of regulation the part, L, is immovable on account of the heaviness of the weight, P, and it only swings at the moment of lighting, when the arc is broken and the carbons separated. The regulator we have just described works with continuous or alternating currents as occasion may require. At the concert-hall at the Champs Elysées the burners are worked by an alternating current Siemens' machine; there are sixteen of them arranged in four distinct circuits.



The little vibrations produced in the mechanism by the alternating currents are very favourable to the working of this system, in which the carbon-holder is maintained by the friction of the rod between the tube and the brake. The apparatus can work with currents of very different intensities without changing any part of its mechanism.

In order that this object may be effected, the distance of the counterweights, P and P′, from the centres of the levers, L, L′, is adjustable; and, moreover, the relative position of the movable bar, F, and the armature, *p*, can be altered so as to obtain a very delicate adjustment.

At the concert-hall of the Champs Elysées the lamps work normally with carbons 10 mm. in diameter, a current of 10 ampères, and a difference of potential of 60 volts at the terminals of each lamp. The light presents very great steadiness, and the mechanism is so simple that the system has worked up to the present without any hitch.

TELEGRAPHS IN CHINA.

[We find the following article in the *Shanghai Courier*, and as we also receive private information that the facts are authentic, it may be of interest to many of our readers, and to all it will form a relief to the ever-recurring topic of electric lighting.]

Now that a land line of some 900 miles in length, connecting Tientsin with Shanghai, is erected and open for the transmission of public messages, it may be worth while to examine the future prospects of telegraphic enterprise in this country, and to view the probabilities of further extensions. This line, with a line from Tientsin to Taku and Peh Tang, is, we believe, the property of the Chinese Government, and is managed exclusively by Chinese officials, and worked by some six or seven operators of the Great Northern Telegraph Company. The erection of the line was entirely due to the scare induced by the anticipated war between Russia and China in 1880-81, and the money granted for the cost of construction was voted by the "Imperial Defence Bureau."

It is somewhat curious to speculate as to the reason why the long-shown antipathy of the Chinese Government to telegraphs was gradually swept away from the celestial mind. Up to the year 1876 the most violent dislike to anything telegraphic, necessitating posts and wires, or any visible obstruction to the beneficent influences of Fung Shui, was always manifested—witness the prolonged but abortive attempt of the Great Northern Company to erect a land line from Foochow to Amoy. But in 1877 a distinct change in their policy took place. As soon as the Chinese Government found it possible that native clerks could be taught to work the Morse telegraph instrument, and native workmen could erect land lines, permission was given to build a line, and a line was accordingly built from the Viceroy Li Hung Chang's Yamen to the Torpedo College, by Mr. Betts, the torpedo engineer to the Chinese Government. This was speedily followed by a line from Tientsin to the numerous forts at Taku and Peh Tang. The great convenience of this line was at once apparent to the Viceroy, for military orders could be transmitted and a reply received immediately. The first official message sent over the line was an order from the Viceroy to the Commander of the forts, to "dress" the forts and men-of-war, and fire a salute of twenty-one guns on the arrival of the U.S.S. *Ashuelot*, with General Grant on board; and to report the vessel on being sighted at Taku.

In 1880 it was decided to connect Shanghai with Tientsin for the purpose of enabling Li Hung Chang to receive news from the outer world and to confer with his colleague at Nankin, with a view of devising measures for the defence of the Yangtse from Russian attack. The Great Northern Telegraph Company obtained the contract to build the line, and at once commenced work. Without the slightest opposition from the people the line was built and opened for traffic in December, 1881; a marked contrast to the attempt at Foochow in 1874-5, where, after two years of futile efforts, the line was abandoned.

An extension from Chinkiang to Nankin has been determined upon, and further extensions are projected. If these extensions are carried out they will have a very important bearing upon the value of foreign cable property in the Far East. The next line which is proposed is from Nankin to Hankow, and if this line is built it will no doubt act as a very valuable feeder to the cables in the tea season; but should the contemplated extensions to the South of China be carried out, and the lines remain in the hands of the Chinese Government, it will inflict a very serious blow to the prosperity of the Great Northern cables.

The Great Northern Telegraph Company at present have cables from Hongkong to Shanghai (looped into Amoy), thence to Nagasaki, thence to Wladivostock, where the cables join the Siberian land lines. These cables were laid in 1870, are technically known as "Hooper's" core, and vary from 1½ tons to 18 tons per knot. The insulation of the cables is said to be in a very bad state, so bad that heavy battery power is employed on some sections, and break downs, as we all know, are of frequent occurrence. In January of the present year the cable was broken in three places at the same time, viz,, south of Gutzlaff, north of Gutzlaff, and between Shanghai and Gutzlaff. These faults had not been repaired more than a week or two when, on February 12th, the cable was again broken near Amoy. Before the cable ship could return to Shanghai after repairing the fault, the cable was again broken between Shanghai and Nagasaki. This two months' state of affairs may be considered but a fair sample of the condition of these cables, and in no way exceptional. Naturally much dissatisfaction is felt by the Shanghai public at these constant interruptions, and coupled with the angry feeling caused by the excessively high word-rate, would lead it gladly to use any alternative route if open to it. Should the Chinese extend their land lines to Canton and thence to Hongkong, such a route would be opened, and the European traffic would undoubtedly pass over the cables of the Eastern Extension Company; while of the local coast traffic, at least the greater portion would be diverted from the Great Northern cables (even when working to the Chinese land lines).

It is no doubt a consideration of these facts which is so strenuously urging the Great Northern Company to attempt to obtain from the Chinese a concession for the construction of land lines in China.

A land line from Shanghai to Canton, thence to Hongkong, in their own hands would practically duplicate 1,000 miles of cable, south of Shanghai; while a line from Tientsin to Pekin and thence to Kiachtka on the Siberian frontier, would duplicate about 1,000 miles of cable and some 1,200 miles of land lines, as far as European traffic is concerned. As these cables must sooner or later be renewed, at an expenditure of some £300,000 sterling, unless the control of the land lines can be obtained, the importance of the question to the Great Northern Telegraph Company cannot be overlooked, and it is certainly to be hoped that in the interests of the world at large, and Shanghai in particular, the land lines may be built, whether by the Chinese Government or the Great Northern Company is a matter of small importance to the public, so long as the residents in Shanghai have some reliable means of getting a message through to Europe.

THE MAGNETO-SOUNDER.

FIELD TELEGRAPH WITHOUT BATTERY.

In certain special cases, under favourable conditions, the telegraph lines can be extended to battle-fields. However, notwithstanding their lightness, they cannot be moved easily enough to follow up the manœuvres, and very frequently their fragility would render their preservation a matter of great difficulty in the midst of military operations.*

On the other hand, it must be admitted that it would be useless and impossible to use the telegraph at a distance less than six kilometres from the front of an army in action; useless, because, it would be quicker to send messengers; impossible, because it could not be worked under fire. However, for communication between the main guard and the sentinels, or between the batteries and the posts of observation, endeavours have been made to fit-up light telegraphs, capable of being conveyed by a few men; these may be called advanced post telegraphs. Each installation generally contains one kilometre of cable, which enables lines two kilometres in extent to be filled up between two stations.

At the time of the discovery of the telephone it was thought that this new instrument was destined to take the place of these telegraphs. But the experiments during the Russo-Turkish war soon showed that the noise of an army almost always, except in the silence of the night, prevents the voice from being heard. The most perfect telephones were however known at that time, those constructed by Siemens at Berlin and by Gower at Paris.

The microphone even does not amplify the sounds sufficiently to render them perceptible under all conditions. It requires a battery, which is cumbersome and necessitates a certain regulation of position in relation to the vertical,

* "La Télégraphie Electrique de Campagne." By Van den Bogaert, officer of the Belgian Engineers.

which is inconvenient. Finally, it must be placed on a fixed stand, for it produces deep sounds when vibrations are communicated to its support. It has therefore been rejected altogether; as to the telephone, it has been admitted that under certain conditions, it can be of service, and in the greater number of armies, it has been added to the light telegraphs already in use. The following are some of the different systems.

(A.)—Systems with Permanent Signals.

I.—*The Prussian Telegraph of Bückoltz*, employed by the Company of Belgian Campaigning Telegraph Operators. This apparatus has a return wire and is worked by a continuous current, *i.e.*, when there is no transmission, the current passes through the line and gears the clockwork mechanism: the signals are then produced by the interruption of the current, which throws the mechanism out of gear. Consequently, directly the cable is cut, the operators become aware of it.

The instruments work together, *i.e.*, the despatch is recorded simultaneously at the two stations. A recent improvement enables us to pass from the continuous current to the ordinary current by means of a commutator.

A complete installation comprises:

(1.) A case $0^{m.}\ 15 \times 0^{m.}\ 14 \times 0^{m.}\ 15$, containing the galvanometer and the manipulator. The last model is somewhat larger.

(2.) The battery, consisting of 12 Siemens elements with sulphate of copper. It weighs 12 kilogrammes.

(3.) Two coils of 500 metres of cable with two wires, one carried in a sort of infantry bag, the other in a case.

II.—*The Russian System of Dereviankine* is very similar to the above; the earth is employed as return conductor.*

Remarks.—The field telegraphs of Bückoltz and Dereviankine are the only ones that give permanent signals. They are excellently arranged; we think it would be impossible to condense any further the component parts, which are essential if we wish to keep copies of the despatches; but this does not seem to be altogether necessary. In America, on almost all the permanent lines, the despatches are sent by sound alone, and in campaign telegraphy it is very seldom that important orders are transmitted of which it is necessary to keep a copy.

(B.)—Systems with Momentary Signals.

(*a.*) *Optical Telegraphs.*

I.—*Trouvé System.*—This is only a miniature, about the size of a large watch, of an ordinary dial telegraph, with simplified mechanism. The receiver is worked by clockwork; the manipulator is worked by a button similar to that in keyless watches. The wet battery and a kilometre of cable are placed on a yoke to be carried on a man's back.†

II.—*Wheatstone One Needle System* (in use in the Spanish army).—It comprises as a receiver a vertical galvanometer, the needle of which deviates to the right or to the left, according to the direction of the current transmitted. The deviations to the left form the dots, and those to the right the dashes of the Morse alphabet. The manipulator, which resembles all those of the Morse type, is worked by reversals of the current; it is placed above the galvanometer, which is only 8 or 9 centimetres in height.‡

III.—*Prussian Needle Telegraph with Earth Battery.*—This system is similar to the preceding one; the current is supplied by two pieces of zinc and copper, which are buried in the damp earth. It was used during the war of 1870.§

Remarks.—The Trouvé system is very delicate; the two others are more solid and better suited to military operations. But it is very difficult to read the Morse signals indicated by a needle, and it cannot be used at night. As a sound can be heard at any time, sounders are preferred to the above instruments.

* Paris Exhibition of 1881, No. 1,700 in the catalogue.
† *See* Du Moncel. "Les Applications de l'Electricité."
‡ "Minas Hydraulicas Defensivas," por el Coronel Scheidnagel.
§ Laurencin, "Le Télégraphe."

(B.)—Sounders.

I.—*The Caton Sounder* (employed exclusively in the military telegraph of the United States).—It is simply an electro-magnet, the armature of which forms the sounder. It is contained together with the manipulator in a little case, $0^{m.}\ 15 \times 0^{m.}\ 06 \times 0^{m.}\ 04$.

The battery employed contains several elements with sulphate of copper.

II.—*The Sounder of the French army*, smaller in size but similar to the preceding one, employs a wet battery or a reversible one.

III.—*Dereviankine's Russian Sounder*, also similar to the Caton sounder, is only $0^{m.}\ 10 \times 0^{m.}\ 08 \times 0^{m.}\ 05$.

IV.—*The Spanish Sounder*, with dimensions similar to those of the French sounder.

V.—*The Trouvé Sounder* has the appearance of a large watch. The accessories are the same as those of the portable telegraph by the same inventor.

Remarks.—All these sounders have the inconvenience of requiring a somewhat powerful, and consequently cumberous, battery. The Trouvé battery is the lightest, but the apparatus worked by it has rather a limited value. At the time when it was shown by experiment that the telephone was of little use to reproduce speech at the vanguard of an army, it was found that under the influence of battery currents, and especially of the high tension currents of induction coils, this apparatus gave sounds of great intensity. When a current is sent into the circuit of a telephone the magnetism of the magnet which constitutes it varies, and the result is a variation in the action of this magnet on its diaphragm of soft iron. Two different sounds are then heard, one when the current is established, the other when it ceases, and thus long emissions can be distinguished from short ones, as in the Morse sounder.

In order to produce a sound of greater intensity, serving to warn the correspondent that the transmission is about to commence, the interrupted current of a little Ruhmkorff coil is employed; a continuous current can also be sent into the line, the interruptions being produced by the plate of the telephone itself, by arranging it like the armature of a trembling bell. (Captain Ferrodon's alarm.)

The instruments constructed according to the above principles are:—

(C.)—Telephonic Sounders with Battery.

I.—*The Racagni-Guglielmini System.**—These inventors arrange their induction coil either in the handle of one of the telephones, which also contains the manipulator, or on the reversible battery, which has the form of a cartridge-box. They employ an electro-chemical receiver with paper band, which seems to have the drawbacks of the Morse system without possessing its advantages.

II.—*The Mangenot System* is identical in principle with the preceding one. The battery is also in the form of a cartridge-box, and contains the manipulator and the induction coil. The inventor, acknowledging the inconvenience of his battery, which is never hermetic, and which becomes polarised, proposes to substitute for it a Clarke machine, weighing $2^{lbs.}$ 500. In the event of it being impossible to hear sounds, he proposes to receive by the sense of touch, by placing the lips on the terminal of connection of the telephone. It will be remembered that a very skilful telegraph operator in 1870 received a message in this manner across a cable submerged under the Seine; but this was really a feat which would require no common degree of skill to perform.

Remarks.—All these instruments have the drawback of requiring cumbrous batteries, which the slightest accident would render useless, and which require great care. M. Mangenot proposes to substitute for them an induction machine, which is too heavy and which presents the great disadvantage of requiring a man to turn the handle. The solution of the problem must evidently be sought for among the following instruments:—

(D.)—Telephonic Sounders without Battery.

I.—*Colonel Jacobi's Télékal.*—The complete installation comprises a long-distance telephone, and a case $0^{m.}\ 21 \times 0^{m.}$

* Electrical Exhibition of 1881, Italian section, No. 1,605.

11 × 0m. 33, weighing from five to seven kilos., and called the *Télékal*.* It is furnished with a Morse manipulator, worked in the ordinary manner; by means of a little handle the manipulator can be made to ring so as to call the correspondent.

We can also employ for this purpose the trumpet call with which long-distance telephones are supplied, whether constructed by Siemens or by Gower.

The advantages of the télékal are, according to the inventor, that it can be worked without battery to considerable distances, far beyond the limit at which the voice can be heard without being affected by the telegraphic transmissions of neighbouring wires or external noises. It requires no regulation of position like the microphone, and is of great solidity.

We have in vain sought for information on the principle of this apparatus; its inventor preserves absolute silence on this subject.

II.—*The Magneto-Sounder*.—It seems to us that the télékal was still very heavy and very bulky. We have therefore sought after an apparatus which should offer the same advantages, but have less weight and less bulk. Fig. 1

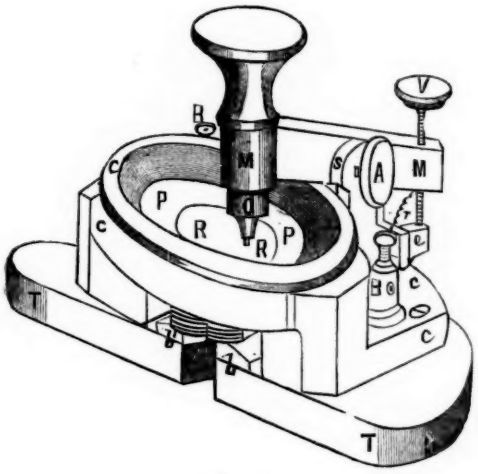


Fig. 1.

represents the arrangement at which we have arrived. A plate of soft iron, P P, is firmly fixed into a frame of copper, *c c c*, facing the poles of a flat horse-shoe magnet, T T, similar to those of the Gower telephones (*see* fig. 2). These

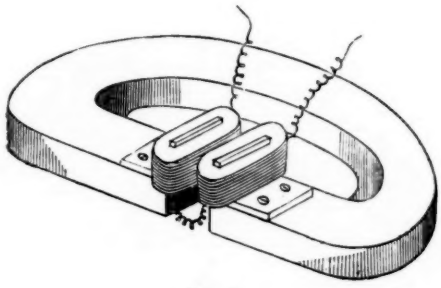


Fig. 2.

poles are, as we know, placed opposite one another, and very close together; on each of them is screwed a little square of soft iron, enveloped in a coil of very fine insulated wire. This wire is coiled in such a manner that the current passes in a contrary direction in the two coils.

The two free extremities of the wire are soldered on to the terminals, B B, the plate, P P, has a projection, *i.e.*, it bulges out in the centre so as to be elastic under pressure like metallic castanets. This pressure is produced by a small Morse lever, M M, supported by the projection, S, of the frame of copper, *c c c*, by means of the axle-screw, A; V is a regulating screw which serves to limit its play, and *r*, an opposing spring.

The apparatus thus constructed only weighs 250 grammes more than the magnet which forms part of it, or 750 grammes in all. It can be contained in a box, 12c. 5 × 9c. × 5c., only the button of the manipulator, and the two terminal screws, B and B′, being left out.

In order to use it the terminal, B′, is connected to the line, and B to one of the poles of a Bell telephone, the other pole being connected to earth, as is shown in fig. 3.

Fig. 3.

When used in active service, the magnetic sounder is suspended on the breast by a strap, and the hilt of a sword stuck into slightly damp soil forms an earth. The operator then works with his right hand as with the Morse manipulator, and applies the telephone to his ear with his left hand. In order to make the working of the apparatus clearly understood, we must first explain that of an ordinary telegraphic sounder.

In the written Morse alphabet, the different letters are represented by combinations of dots and dashes. The telegraphic receiver reproduces these dots and dashes on a slip of paper by the pressure, more or less prolonged, of the armature of an electro-magnet, which is lowered every time the current passes through, and is raised by means of a counteracting spring. In this system · — represents *a*.

It does not work in this manner when the signal is received by the ear. The movement of the armature is limited by two stops, when it falls it strikes one of them and produces a sound, when it rises it strikes the other and produces another sound. We can therefore note the duration of the time it is lowered; if very short the two different sounds interfere with one another. Thus *a* is represented by (•) ● × if we represent by ● and × respectively the sounds of the falling and rising of the armature.

In the *magneto-sounder* the transmitting mechanism is identical with what we have just described. When the plate is brought towards or drawn away from the coils a current is produced in them arising from the increase or decrease of the magnetic action on this plate acting as an armature. Currents are thus sent into the line and produce sounds in the receiving telephone.

The apparatus constructed by Richez & Cie., at Brussels, has fulfilled all our expectations. We have tried it on a telephonic line and were able to correspond freely. We introduced 6,000 Siemens units, *i.e.*, about 600 kilometres of telegraphic iron wire 4 millimetres in diameter into the circuit without producing any appreciable effect on the clearness of the sounds received; we had no further resistances at our disposal, but everything led us to believe that experiments made on long lines would be crowned with success. The new apparatus can, therefore, be substituted for the Morse sounder in all its applications. It has the advantage of being very light, of not requiring any battery, and of being extremely sensitive. Finally, it comprises a telephone which can be used in the ordinary manner.

The above description of the magneto-sounder for field telegraphs is an extract from the *Revue belge d'Art, de Sciences, et de Technologie Militaires, septième année* (1882), *tome* II., and is written by Lieutenant L. Weissenbruch.

Danger from Electric Lighting.—We are informed that an inquest is to be held on the victims of the accident which we noticed in our "Notes" of last week as having recently occurred in the gardens of the Tuileries in Paris. M. C. M. Gariel is charged with the technical part of the inquiry, and Dr. Bronardel with the autopsy of both bodies.

* See the original description by the inventor in *La Lumière Electrique*, 3rd year, No. 35.

CORRESPONDENCE.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer, not necessarily for publication, but as a guarantee of good faith.

Correspondence should arrive not later than Tuesday morning if it is desired to appear in the following number.

THE PRINCIPLE OF CARBON TELEPHONES.

To the Editors of The Electrical Review.

Sirs,—In reference to the principle of carbon telephones I have made the following experiment, which, I think, will interest your readers. On one side of a block of gas carbon, 155 mm. long and about 30 mm. diameter, I bored two holes, 7 mm. deep and 110 mm. from each other. They were then filled with mercury, and the arrangement placed in circuit with a battery and telephone by means of *amalgamated* copper wires dipping into them. On striking the block with a ruler the blows were loudly heard in the telephone. The block was then placed on a piano, every note of which was distinctly audible; and even speech was faintly heard.

Yours faithfully,

F. DE WOLFFERS, FILS.

56, Portland Place, Clapham, S.W.

August 11th.

THE TELEPHONE.

To the Editors of The Electrical Review.

Sirs,—It seems evident to me that Mr. S. Thompson, in his reply inserted in the last number of your journal, has not kept to the subject. He will allow me, in the first place, to tell him that I have for several years been well acquainted with the effects of imperfect contacts, even between metallic substances, and have studied them at various times since the year 1856. I sent you the analysis of these researches, which you were good enough to publish in your journal for the 10th of June; and it is because I have carefully studied these effects that I know that electrical variations, resulting from a more or less close adherence of the contacts, are more limited with metallic conductors than with imperfect ones. Therefore when I say that Reis's receiver with needles cannot reproduce speech loudly, I suppose the original transmitter of Reis to be used, and not any improved apparatus, such as those of Hunnings and Ader. It is certain that with good transmitters and a powerful battery articulate sounds can be obtained from a similar kind of receiver, and M. Ader's *speaking table*, which I have described in the two last editions of my work on the telephone (*see* p. 380 of the fourth edition, and p. 317 of the third) is a proof of this. I had even asserted this in the year 1878, at the time of my discussion with Colonel Navez, but what seems to me difficult to believe, is that this effect can be obtained with the metallic contacts employed by Reis. The question is not what can be done at the present day, but what could be done in 1863. Besides, experiment has shown M. Ader that his speaking table could only reproduce sounds at a very short distance—from one room to another, for instance.

On the other hand, while asserting that speech can scarcely be reproduced in Reis's needle receiver with his metallic contact transmitter, I will readily admit that it can be effected with this transmitter, if an improved Bell receiver be used, and if the receiver alluded to by Mr. S. Thompson, with which I am not acquainted, is under analogous conditions, I can agree with him. It would, however, still be very extraordinary that such an important discovery should not have had more publicity, and that our attention should have been called to it from America.

As to the principle of the variability of the intensity of currents with imperfect contacts when submitted to various pressures, Mr. S. Thompson will allow me to tell him that in the year 1874 I had asserted and *proved* that the actuating cause was the *variation in the closeness of the adherence* of the two contacts, and this hypothesis has been maintained lately by Mr. Thompson himself, and also demonstrated in 1879 by Mr. Barrett. But the field of electrical variations is more extended with bodies of moderate conductivity, as the effects are then due to several causes:—first, the more or less close adherence of the contacts; secondly, the amount of surface of the two conductors in contact, which is equivalent to a sectional variation; thirdly, the degree of subsidence of the molecules of the conductors in contact; fourthly, the different conditions in the gaseous medium interposed between the surfaces of contact, and, perhaps, even the various conditions of a *disruptive* discharge of the current, inappreciable to the observer, but perhaps producing an effect on the telephone. Recently experiments on these points have been undertaken by English *savants*, and I believe they help to elucidate this question, which is still obscure. But in my opinion it is certain that all these causes manifest themselves simultaneously, and to a greater or less degree according to the nature of the conductors, and the effects are more or less forcible according to whether the conductors are favourable to them or not; and this is why carbon transmitters, or those constituted of metallic ores or agglomerations of metallic filings, are the best for telephonic purposes.

TH. DU MONCEL.

Lebisey, *August 8th*, 1882.

THE POST OFFICE AND THE TELEPHONE.

To the Editors of The Electrical Review.

Sirs,—The public have read with extreme gratification that our Liberal Postmaster-General has relieved the telephone industry of the one difficulty which attended its extension, by promising to license the operations of all telephone companies.

Last winter I addressed a crowded meeting in the Theatre of the Society of Arts, under the presidentship of the Right Honourable E. P. Bouverie, on the subject of this industry and the great public benefits which would accrue from the wide extension of telephone exchanges throughout the land, at rates of subscription which would bring it within the reach of every one for social as well as commercial purposes, and still return a handsome profit to the undertakers.

In noticing the slow progress the use of the telephone exchange has made in the United Kingdom, in comparison with other countries, I showed the audience how the construction, maintenance, and working of the systems should be adapted to the wants and prejudices of the public at large, and how necessary it was to commence operations, so as to avoid the natural dislike of the community to the unsightliness and inconvenience of the ordinary poles and wires of our telegraphs, and, that the true way to overcome these obstacles was to enlist the public of each locality in the establishment of telephony for the use and convenience of the majority.

The application of this simple and naturally cheap help to the daily transactions of life is an infinitely easier matter than that of electric lighting, and yet we see the public investing deeply in those industries and almost neglecting the telephone industry altogether.

It can be easily shown that the establishment of a telephone exchange of one hundred subscribers, within a square mile, and costing each subscriber not more than 6d. a day, will safely pay an interest of more than 15 per cent. to the capitalist, after providing 65 per cent. for working, maintenance, and renewal expenses, and that every further extension in the same area will largely increase that return.

It is to be reaped in any part of the kingdom in which 100 persons, able and willing to subscribe 6d. a day for the convenience, can be found within a square mile. All experience in other countries shows that once introduced it spreads rapidly, and once established, it becomes a necessity, like water, light, &c.

The money value of the saving in labour to the community is far in excess in proportion to the value of the plant, in comparison with the saving arising for like reasons out of the use of the State telegraphs, because the average traffic is far more and the cost of manipulators is saved, as the public speaks its own messages.

A bill somewhat on the same lines as that for electric lighting would smooth any difficulties which are still encountered in the extension of the telephone systems, and

by cheapening the first cost to the companies undertaking the work, would also cheapen the service to the public. Bills of this kind have generally to be promoted by industries. The public cannot do better than support by their adhesion the companies which now appear to be springing up, with the object of extending true, cheap telephony. The ultimate reward to good work and good management is so secure, if the companies are established and worked on sound financial principles, that there is no industry which can offer fewer risks to the investor.

The objection to the public use of the fundamental principles of the invention, raised by the owners of patents, can never stand before the fair test of a scientific investigation.

All monopolies must fall immediately the public becomes aware that they are standing in the way of a great social necessity.

C. E. WEBBER,
President Society Telegraph Engineers and of Electricians.

August 11th, 1882.

IMPROVEMENTS IN ACCUMULATORS.

To the Editors of The Electrical Review.

Dear Sirs,—In the number of your interesting Review for July 29th you have described some experiments made with modified Faure accumulators, the results of which have been published in the *Annales de l'Electricité*.

In reproducing the general results alone, you accompany them with guarded remarks based on an inexact and incomplete understanding of acquired facts, which I can only explain by a bad translation.

You will allow me therefore, I trust, for the edification of your readers, to put the matter in its true light.

The following, to begin with, are the results of two published experiments.

A. An accumulator containing 3·145 kilogrammes of *minium* and 4 kilogrammes of lead was taken.

During	15 m.	a current of	10 amp.,	that is	2·5 amp. hrs.
,, the next	2 hrs.	,,	9½ ,,	,,	19· ,,
,, ,,	8 hrs. 15 m.	,,	9 ,,	,,	74·25 ,,
,, ,,	15 m.	,,	6 ,,	,,	1·50 ,,
	10 hrs. 45 m.		Total ...	...	97·25

Or a current of 9 ampères during 10 hours.

In explaining the formula $Tr = \frac{E\,I}{g}$ we have

$Tr = \frac{2{\cdot}15 \times 9}{10} = 1{\cdot}935$ kilogrammètres per second, from

which 1·935 × 36,000 = 69,660 kilogrammètres, which makes 22,149 kilogrammètres per kilogramme of active matter (3·145 k. of minium).

B. An accumulator containing 8·100 k. of minium and 8·800 k. of lead was taken.

During	6 h. 30 m.,	a current of	13·33 amp.,	that is	86·64 amp. h.
,, next	9 h. 30 m.	,,	13· ,,	,,	123·50 ,,
,, ,,	45 m.	,,	12· ,,	,,	9· ,,
,, ,,	15 m.	,,	11· ,,	,,	2·75 ,,
,, ,,	45 m.	,,	10· ,,	,,	7·50 ,,
,, ,,	15 m.	,,	9· ,,	,,	2·25 ,,
,, ,,	30 m.	,,	8· ,,	,,	4· ,,
	19 h. 10 m.*		Total ...	...	235·64

Or a current of 13 ampères during nineteen hours.

We have by the following formula :—

$Tr = \frac{2{\cdot}15 \times 13}{10} = 2{\cdot}795$ kilogrammètres per second,

from which 2·795 × 68,400 = 191·178 kilogrammètres, or 11,371 kilogrammètres per kilogramme of minium and of lead, or 23,600 kilogrammètres per kilogramme of active matter (8·100 k. of minium).

Such are the figures.

I will add that the measures of the intensity of the current were taken every 15 minutes by the help of a Marcel Deprez galvanometer.

You say that in the preceding calculations no account is taken of the weights of the liquid nor of the holder, and you leave it to be believed that I compare figures thus obtained with those given by other experiments calculated on the total weights of the apparatus, that is, 4,000 kilogrammètres per *kilogramme of the accumulator*. Now I have explained that the results of the experiments of Sir William Thomson show that 5,000 *kilogrammètres per kilogramme of lead and of plumbic matter* can be stored.

This figure of 5,000 kilogrammètres is not an exaggeration, it is even below the truth if you accept the published results of Sir William Thomson in the *Times* of June 9th, 1881. Sir William Thomson states in effect that he had obtained from an accumulator weighing 8·500 k. a quantity of work equal to 260,000 foot pounds, or 35,900 kilogrammètres. I have tried an apparatus of the same pattern and of the same formation, containing 5·700 k. of plumbic matter, that is to say, of lead forming the supporting plates, and the minium ; the weight of this last was about 3·500 k. after its transformation into *spongy lead* on one of the plates and peroxyde of lead on the other, this constitutes the *active matter*.

From these figures it results that Sir William Thomson has extracted 6,300 kilogrammètres per kilogramme from the plumbic matter, or 10,250 *kilogrammètres per kilogramme of active matter*, or 4,220 kilogrammètres per kilogramme of dead weight.

This method of giving the results offers the advantage of showing that some progress has resulted other than in the capacity of storage of active matter, in seeking to diminish dead weight.

Sir William Thomson does not give any details of his experiments, which must be accepted with a certain amount of reserve. Up to the present his figures have not been contested ; interpreted as I take them they will certainly make those which result from my experiments appear to you less fantastic.

Further still, you make me say that "the discharge operates with a constant electromotive force of 2·15 volts," which is not exactly the case. You add, "The intensity of the current through an unknown resistance at the commencement of the discharge is 13·33 ampères, whilst it is no more than 8 ampères at the conclusion." What is not quite correct is your way of making me say that the electromotive force 2·15 volts is constant. You have made me to say, with as much truth, that the intensity of the current was *constant*, and that the action of the *pesanteur* at Paris is equal to 10. The truth is that I have simply sought to approximate the mean figures, which is not exactly the same thing. It is true, however, that the current varied from 13·33 to 8 ampères ; but the duration of the discharge having been 19 hours 10 minutes, and the intensity of the current having taken only 3 hours to fall from 13 to 8 ampères, by neglecting this quantity and keeping 2·15 as the electromotive force for the remainder, the amount of energy stored is still more than 20,300 kilogrammètres per kilogramme of active matter.

In order to measure the electromotive force I had only at my disposal a fine wire Marcel Deprez galvanometer, which was insufficient for exact measurements ; I was obliged, therefore, to have recourse to the figures resulting from previous experiments. Now, I read in the same number of the *Annales de l'Electricité*, in the column next to those where are the figures under discussion, that the constant relative electromotive force of the Faure battery is 2·15 volts for the 6·50 k. size. The value is that of M. E. Reynier.

In the number for May, 1881, of *L'Electricien*, page 75, M. Niaudet says that the result of *careful* measurements of the electromotive force of the Faure accumulator shows the value to be 2·25 volts ; and he gives figures for evaluating the work in kilogrammètres by the formula—

$$Tr = \frac{E\,I}{g}$$

M. G. Planté, in his "Recherches sur l'Electricité," page 75, says that when a single secondary Planté couple, well formed, is worked with, the greater part of the numbers found for the electromotive force are between 1·45 and 1·50, the Bunsen being taken as the unit. Now, as the electromotive force of a Bunsen is between 1·89 and 1·96 volts—(Niaudet gives 1·734)—therefore if we take the value of the Planté to be 1·45 of the Bunsen, and the latter to be 1·80 volts, then this gives 2·61 volts as the electromotive force of the Planté (2·51 according to M. Niaudet).

In the same number of the Electrical Review for 29th

* Our Correspondent's figures only make 18½ hours.

July, page 64, there is an article extracted from *Nature*, and entitled "The Chemistry of the Planté and Faure Cell," in which it is stated that the initial electromotive force of a battery freshly charged varies from 2·21 to 2·31 volts, the mean value being taken as 2·25; but after thirty minutes' rest, or of discharge it becomes reduced to 2 volts. This fall is attributed to the liberation of the gas accumulated on the electrodes. In another experiment the electromotive force fell from 2·25 to 1·92 in forty-five minutes, and recovered to 1·96 after thirty minutes' rest, and to 1·98 after eight hours' rest, but the internal resistance was in this case ·58 ohms. Is this resistance that of the whole battery or of a single element? In this last case it is important to know in what condition was the element in question, since the resistance of the accumulator in good condition has been found to vary from ·006 to ·040 ohms during the discharge.

Finally, the experiments of MM. Allard, Le Blanc, Joubert, Potier, and Tresca, have proved a diminution of electromotive force from 2·165 to 2·057 volts, whilst the current falls from 16·37 to 11·49 ampères. In these experiments a sufficient time elapses between the end of the charge and the commencement of the discharge.

In these figures it appears to follow that the constants of the Faure battery are not the same for all the elements, and that they differ according to the state of each. Well, do you not think that it is possible to make these constants much more uniform by regulating the chemical reactions and to increase the storage capacity by facilitating and rendering these reactions more complete?

Why cannot the accumulators be improved as regards the minium? Is it extraordinary to expect to see double the power in the active material in these elements? M. Faure has written somewhere that it is scarcely possible to obtain the tenth part of what the minium can give; there is still, therefore, some margin, and since the accumulator is perfectible, why cannot it be perfected like the steam-engine, for example? The consumption of fuel in the latter has been reduced from 8 or 10 kilogrammes per horse-power per hour down to less than 1 kilogramme. If, now, you wish to be astonished by the reality of the progress already accomplished in the construction of the Faure battery, then, according to ordinary principles, before the application of the active matter on the plates, simply intimately mix with it a very porous and finely divided substance, and you will certainly be less incredulous when you see it work.

I venture to hope that you will not find this letter, foreign to all industrial speculation, too long to be inserted in your next number.

I am, dear Sirs, yours faithfully,

C. BLANCHART.

THE CITY AND GUILDS OF LONDON INSTITUTE TECHNOLOGICAL EXAMINATIONS, 1882.

To the Editors of THE ELECTRICAL REVIEW.

SIRS,—Your readers are, no doubt, much indebted to your correspondent, "Fareham," for having, in a recent issue of your paper, brought under their notice the decisions of the examiners in the electrical subjects of these examinations. But while they will also certainly join with him in acknowledging the desirability of having theoretical excellency supported by practical ability, I am confident they will lend no approval to his eminently Quixotic tilt against the scope of the work of this useful organisation. The machinery and work of the City and Guilds of London Institute are subject to the two considerations which rule as regards material appliances, viz., practicability in the first place, and then financial economy. Let "Fareham" give a little careful thought to the matter, as others have done, and he will find that the elaboration and consequent expense required to conduct these examinations on the lines laid down by him would altogether fail to yield a commensurate advantage.

But, after all, it may be that "Fareham" is afflicting himself with needless concern. I may be mistaken, but I understand those only are eligible for examination in any industry who are practically engaged in that special industry. Moreover, the examiner in telegraphy has said in effect (I write from recollection,) that he had no difficulty in estimating from the papers the extent of the respective students' practical acquaintance with the subject. And in all likelihood the same will hold with the other examiners.

In support of his somewhat vehemently expressed dictum that paper examinations are utterly useless, "Fareham" instances a circumstance, but the inexactness of the narrated details makes impossible the formation of any opinion from them. A is a telegraph testing clerk, we are told; B, a young operator. Five years ago A obtained in magnetism and electricity a "first-class certificate"—whether elementary, or advanced, or honours, "Fareham" leaves to speculating theorists to discover. However, A devotes the greater portion of his time during the five years following to the study of technical telegraphy, and in so doing must, your readers will presume, pay close and enthusiastic regard to the results of invention and research chronicled periodically in the scientific press throughout that period. Yet "Fareham" asserts of this devoted student, who is taken to be typical of practical men, that being so destitute of ability to express himself upon paper, in a recent technological examination in telegraphy, he is signally out-distanced by B, who has attended some class for only six months. The statements in the previous sentence are remarkably strange, in fact, scarcely credible, and since "Fareham" has built his entire argument upon this case, possibly he will not object to make a second and exhaustive inquiry into the facts, and communicate the result to your paper. According to "Fareham," B obtains an honours place, a position understood to be attainable only by those who have at least *some* knowledge of dynamics, chemistry, and mathematics, in addition to a creditable acquaintance with electrical phenomena and laws, and with practical telegraphy.

As regards A's discomfiture, many will in the meantime, like myself, draw the inference that his capacity and his industry are alike microscopic, and that as for the practical testing duties devolving upon him they are likely to be of an exceedingly common and simple order.

A. C. S.

College of Science and Arts,
Glasgow, *August 14th*, 1882.

THE TELEPHONE.

To the Editors of THE ELECTRICAL REVIEW.

SIRS,—The suggestion made by your correspondent, "Justice," that "the too easily gulled British public should consult scientific publications instead of financial newspapers when it is asked to subscribe to schemes which embrace the development of scientific inventions," seems to be good common-sense advice, and, for the benefit of the too oft self-deluded public, I send you a few remarks and official statistics in regard to the numerous British patents for telephones and transmitters.

The first British patent for a speaking telephone was that issued to A. G. Bell, No. 4765, December 9, 1876, which, however, was greatly modified by a disclaimer on February 13, 1878.

This patent has undergone critical examination in two courts, viz., at Edinburgh before Lord M'Laren in February last, and at London before Mr. Justice Fry in May last. To those two decisions we are indebted for a clear and concise judicial description of Bell's patent, based upon the evidence given by the most eminent electricians in Great Britain. This decision is of the highest importance to investors in telephone property, whether it be in telephone companies or in telephone patents, because it is so clear and simple that any one possessed of common sense can judge for himself as to what constitutes Bell's patent and what constitutes an infringement of Bell's patent.

Bell's original patent contained eighteen claims, the disclaimer reduced them to eight; of these, the 6th, 7th, and 8th, contain the soul of the patent, which is the same in those three claims.

The 6th claim is, "The combination in the manner described in the fourth and fifth plans, but subject always to the disclaiming notes, of an electro-magnet, with a plate of iron or steel or other material capable of inductive action, which can be thrown into vibration by the movement of surrounding air, or by the attraction of a magnet."

In the suit of the United Telephone Company against Harrison, Cox-Walker, the latter set up for defence the prior publication of a description of Reis's instrument of 1862. In the Reis instrument there was, "facing the poles of the electro-magnet, an armature attached to a broad, thin, but light plate."

As Bell's claim was for a plate of any material capable of inductive action in combination with an electro-magnet, the eminent counsel for the United Telephone Company (Mr. Aston, Q.C.,) said, "The whole case turned on the question of whether or not there was a publication of a receiver having a plate armature prior to December, 1876." He contended that the broad, thin, light plate of Reis, which counsel called a "bar" or "tongue," "was in no sense a plate armature; and as the plate armature was essential in Bell, and the 'bar' used in Reis was in no sense a plate armature, and therefore no anticipation of Bell's."

The plate armature in Bell's is described by Sir William Thomson as an iron or steel disc fixed all around its edges. Mr. Aston insisted "particularly in the fundamental distinction between the 'bar' in Reis and the plate armature in the Bell."

Mr. Justice Fry describes the plate armature of Bell as "a metal disc resting, as regards its circumference, on the wooden case;" and he further says that "the armature in Reis was not a disc at all, it was not a plate at all, but it was a beam or solid bar;" and he decided that the "Reis receiver was not in anticipation of Bell's receiver."

It is, then, clearly established that in a telephone receiver the use of a disc of a material capable of inductive action fixed all around its edges is secured to Bell; and it is further established that a "tongue" or "bar," as in the Reis instrument, is outside of Bell's patent.

I submit two complete lists of British patents for telephone receivers. The first contains those patents in which a disc capable of inductive action is used in combination with a magnet or electro-magnet. The second list contains those in which there is not used a disc capable of inductive action. Let inventors judge for themselves.

List of British patents for telephone receivers in which a disc capable of inductive action is used in combination with a magnet:—

1876.

No.	Date.	Inventor.	Remarks.
4,765	December 9th	A. G. Bell	
	February 13th, 1878	A. G. Bell	Disclaimer

1877.

2,909	July 30th	T. A. Edison	
	February 10th, 1880	T. A. Edison	1st Disclaimer, disc abandoned
	June 13th, 1881	T. A. Edison	2nd Disclaimer
	November 29th, 1882	T. A. Edison	3rd Disclaimer
4,685	December 10th	Siemens	
4,847	December 20th	C. A. M'Evoy	
4,934	December 29th	C. W. Harrison	

1878.

611	February 14th	A. G. Bell	
617	February 14th	G. B. Richmond	
1,779	May 2nd	G. M. Phelps	
1,882	May 10th	E. Gray	
1,917	May 23rd	G. S. Hickley	
2,396	June 15th	T. A. Edison	
2,527	June 25th	Dr. W. Siemens	
3,892	October 3rd	Gower & Roosevelt	
3,960	October 8th	L. V. Mandroux	
4,210	October 22nd	G. M. Phelps	

1879.

315	January 25th	Gower & Roosevelt	
394	January 30th	Gower & Roosevelt	
1,476	April 16th	A. B. Roxburgh	

Telephones without a disc capable of inductive action:—

No.	Date.	Inventor.	Remarks.
2,262	June 1st, 1878	W. H. Preece	
3,004	September 27th, 1878	E. Gray	

If the above be acceptable I shall continue the report of patents of telephone receivers for 1880-81, and for transmitters from Bell's of 1876.

Yours, &c.,

COMMON SENSE.

[We shall be glad to publish the further communication promised by our correspondent.—Eds. Elec. Rev.]

THE ELECTRIC LIGHTING BILL.

House of Commons, Monday, *August 14th*.

On the motion to consider the House of Lords' amendments to the Electric Lighting Bill,

Sir John Jenkins protested against the amendment extending from 15 to 21 years the duration of a licence before a local authority could compulsorily acquire an installation without compensation for retrospective or prospective profits.

Mr. Dillwyn thought 21 years a very long period, and hoped the President of the Board of Trade would adhere to the compromise he had introduced into the Bill.

Mr. Chamberlain said the hon. member for Swansea was correct in his statement of the circumstances under which the compromise of 15 years was arrived at. When he recommended 15 years to the Select Committee, and when the question was last discussed in the House, he was of opinion that that compromise was a fair one, but since then further information had been put before him which had made a difference in his opinion, and which he thought might perhaps also alter the opinion of his hon. friend. When the matter was discussed before the select committee it was certainly believed by that committee that in the present experimental stage of electric lighting there would be no great expenditure of capital, and that if it was intended to make an experiment by lighting a few houses, a street, or some small district, a monopoly of 15 years would be quite sufficient to remunerate the promoters for their outlay. But already, in the short time during which the matter had been under consideration, very great advancement had been made in electric lighting, and now it seemed probable that large instalments would in some cases be made, involving an outlay of hundreds of thousands of pounds, and it did not seem to him that 14 or 15 years would in all cases be long enough to justify a great outlay of capital. If companies were restricted to the shorter period they would not be inclined to invest their capital, and so that development would not be given to electric lighting which was so desirable. For these reasons he had been willing to reconsider his first opinion. An amendment had been proposed in the other House suggesting that the period during which companies should be empowered to supply electric light before being subject to be bought up under the purchase clause should be extended to 21 years. He had objected to that because it would involve the granting of 21 years in the case of small installations as well as large ones, and so he had secured an amendment to that amendment; and in the Bill now came before them the period was a maximum of 21 years, giving the local authorities, in all cases where applications were made to them for permission to experiment, the power of coming to an agreement with the applicants whereby a shorter term might be consented to. Under these circumstances he hoped no grievance would result; and he believed the clause would be found to work satisfactorily, and at the same time prevent a monopoly being set up which would be dangerous to public interests.

Sir John Lubbock said the power which the local authorities would have of purchasing an installation was a very different thing from a monopoly. When the term had been fixed at 15 years, the chairmen of the Edison and the Swan companies protested against it, saying they were not satisfied. He agreed with the right hon. gentleman, that in a case where a quarter or half a million of money came to be invested, and the company was liable to be bought up in 15 years, the term was too short and should be extended. No doubt the hon. member for Swansea was right in saying that the electric lighting was still in an experimental stage, but the fact that it could be carried on successfully and generally had been established by the experience attained at Holborn Viaduct and other places; and the only question now to be decided was, Which was the best system? He hoped the House would agree to the amendment.

The amendments suggested by the House of Lords were then agreed to. Among them were the following:—

In p. 2, l. 29, after "given," insert as a new sub-section:—"A licence may, subject to the provisions of this Act, be granted to a local authority, authorising them to supply electricity within any area, although the same, or some part thereof, may not be included within their own district."

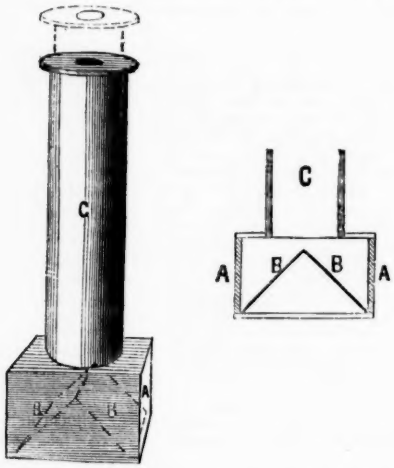
In p. 3, l. 17, after "provisions," insert as a new sub-section:—"No provisional order shall authorise the supply of any electricity by any undertakers within the district of any local authority (not being themselves the undertakers) unless notice that such provisional order has been, or is intended to be, applied for has been given to such local authority, in such manner as the Board of Trade may direct or approve, on or before the 1st day of July in the year in which such application is made; provided that, in the case of any application made during the present year, such notice shall be deemed to have been given in due time if the same is given within one month after the passing of this Act."

Electric Light in the Edgware Road.—An installation of 50 incandescent lamps on the Swan system has just been completed for lighting the premises of Mr. Bouron, provision merchant, at 279, Edgware Road. The lights, which are in use every evening, are a great success and are worked by a small gas-engine on the premises. A great saving is expected in the quantity of provisions usually spoiled owing to the absence of heat in using these lights, the shop therefore being kept cool. The work has been carried out by Messrs. Edmundson & Co., of 19, Great George Street, Westminster, agents for the Swan system, who are engaged also in some much larger installations.

NOTES.

ERRATA.—In the article on the lighting of the Comptoir d'Escompte in our last issue, for "Corrozer" read "Corroyer"; for "each cubic metre" of solution read "for two cubic metres"; and for "ten carbons of ten millimetres" read "with carbons of ten millimetres."

A POCKET PHOTOMETER.—This little instrument, which will doubtless be of service to all who are engaged in electric or other kinds of lighting, has been devised by Mr. Robert Sabine for the purpose of being conveniently carried about in the pocket, so as to be at all times accessible for approximately measuring the respective illuminating power of different lights. Its construction is based on the plan proposed by Ritchie, which we illustrated and described in an article on Photometers in the ELECTRICAL REVIEW of April 8th. In the rectangular base of this little instrument—the



two ends of which are closed by squares of opal glass, A, A, cut from the same sheet—is a prism, B, B, made up of two plane mirrors fixed at right angles. The draw-tube containing the eye piece, in which is inserted a small lens, is movable in the outside tube, C, attached to the base, and a correct focus may therefore be obtained and the mirrors clearly seen from a very short distance,—about 4 inches. Were it not for the introduction of this lens, the tube down which the observer looks would have to be considerably longer in order to obtain a clear view of the plane mirrors. As the operation of using distance photometers is so well known, it is needless to refer to it. Any one could construct such an instrument for his own use at the expense of 2s. 6d. or 3s. The sketch sufficiently explains all the details of its construction. We may add that we believe Messrs. Elliott Bros., the well-known electrical instrument makers, will shortly be able to supply these little photometers to those desirous of becoming possessed of such a useful and handy means of measuring any kind of light.

THE BEWILDERING HIGGS.—In our brief notice of this matter last week we omitted to state that which is, however, already well known in electrical circles, viz., that the legal action taken by Messrs. Siemens Brothers against the subject of our note was dismissed. The *New York Times* of June 16th, after devoting some space to the attainments of Dr. Paget Higgs, says:

He came here under the auspices of S. F. Van Choate, of Boston, Mass., to do some work for the American Cable Company of that city, which required the highest mathematical and electrical knowledge. He was very highly recommended (?) by Siemens the famous English electrician, and the work he was engaged to do was performed in a satisfactory manner. . . . . In the intervals between his work for the cable people he unfolded, slowly and cleverly, the details of a wonderful contrivance he had invented for the transmission of power by electricity, which was stated to be in successful operation in Wales. . . . . A fortune seemed to be within his grasp, and yet he did not seem anxious to reach out and take it. Mr. Van Choate was fascinated with the brilliant future that seemed to be open to any one who could induce Higgs to remain on this side of the Atlantic and develop his plans here. He forgot in his enthusiasm what he well knew, that Higgs' coming to this country was under suspicious circumstances. . . . A company was organised in Boston through the efforts of Mr. Van Choate and Russell A. Ballou. The capital, on paper, was 5,000,000 dols.; the object, to develop Mr. Higgs' plan for an economic electric light, for the electrical transmission of power, and the construction of storage batteries. Mr. Higgs began the development of his theories and ideas, made applications for patents, and frequently reported progress in the most glowing terms. He is said to have received 10,000 dols. for his alleged services in that city. A date was finally fixed for the exhibition of one of his inventions, and the promise was made that if his machine for the transmission of power was successful he should receive 50,000 dols. in cash, and 1,300,000 dols. in stock of the proposed company for his patents and services. He made over all his applications for patents, and, after the manner of Keely, boasted of the probabilities and possibilities of his inventions. The day before the date fixed for the exhibition, Dr. Paget Higgs left Boston, leaving behind him a message that he had left the city because of his father's sudden death. Then he came to New York City, and those Bostonians who invested in his promises have not seen him since, though at intervals he wrote to his friends there informing them of the progress he was making. They trusted him, and so far as can be ascertained sunk more money in the doctor's abysmal pocket. When Dr. Paget Higgs came to New York City he established himself on the parlour floor of a house on Twenty-third Street, facing Madison Square, and threw out his lines for a new lot of fish, so to speak. . . . A company, known as the Higgs Electric Light and Power Company was organised, but as a quarrel ensued between Mr. Higgs and the other projectors of the company, which was to have a capital of 500,000 dols., Mr. Higgs refused to go ahead and perfect his inventions; the company found no further reason for their existence on paper, and went out of business without having done any business. . . . . The inadaptibility of Dr. Higgs to manage the business of the proposed company was known, and one of the gentlemen interested in the doctor and his plans induced a friend, Frederick W. Harne, then superintendent of a slate quarry at Bangor, Penn., to accept the business management of the proposed new company. . . . . He went to Chicago to prepare the way for the organisation and work of the new company. After some trouble he succeeded in securing a plant for the proposed electric light in the Tremont House in that city, and made a contract to light the hotel with Higgs' light. Dr. Higgs was established in a laboratory at No. 63, Kent Street, Greenpoint, Long Island, and began work on the development of his electric light. . . . . All this was about the 1st of January last. About that time, or just before it, he had sold and shipped two electric lights to Montreal, Canada, neither of which would work, a fact not known until comparatively recently, however. About the middle of January he exhibited at Greenpoint, to Mr. Harne and others, a light which he claimed as his own, but which, it has been since proved, was a Wood's lamp run by a Wood's dynamo-machine. . . . . But to return to the Chicago enterprise. Mr. Harne went to that city, established his plant, bought his engines, and on the 15th of February, having paid to Dr. Higgs 700 dols. for dynamo-machines, lamps, &c., after a delay of a week a couple of dynamo-machines arrived in Chicago; but, as Mr. Harne was a novice in the electric lighting business, he did not discover the fact that they were of the Wood make. . . . The complete failure of the scheme induced Mr. Harne to make an investigation into Higgs' antecedents, and he accidentally heard of Mr. Van Choate, in Boston, as having a knowledge of Higgs and his antecedents. In response to a letter of inquiry Mr. Van Choate wrote from Boston, under date of April 2nd, as follows:—

"I imported him into this country a little over two years ago, and for which I am very sorry. . . . . So far as my dealings with him go, I have found him to be the greatest liar, scamp, and fraud of all the men I ever heard of during my thirty years' business with people. He has no capability for inventing anything but lies." . . . . Higgs shipped his wife to England on an Inman steamer as soon as the disclosures of his true character seemed imminent, and he followed her on the *Alaska*, which left this port on May 31st. The various investors were badly left, and the mystery of his inventions departed with him. . . . . The case of Dr. Higgs is a very peculiar one, there seeming to be wholly unnecessary prostitution of undoubted talents. Why this was done does not wholly appear, for he does not seem to have obtained money from his dupes for his personal benefit, and such money as he did obtain was expended in the prosecution of electrical experiments. . . . . It has recently been ascertained that for some unprofessional practices Dr. Higgs was expelled from the Institute of Civil Engineers in England. During his stay here it has been ascertained that the only storage battery that he invented was the previously invented Sellon and Volckmar storage battery; the only dynamo-machine that has worked, the Wood machine; and the only electric lamp, one that will not burn in series and is not a remarkable success as a single light. So far as can be ascertained, the money he has been able to obtain from Americans will not aggregate more than 20,000 dols., unless the losses of the Philadelphians are larger than the 5,000 dols. at which they are estimated. That amount also represents the sum he obtained in this city.

THE CENTRAL LABORATORY OF ELECTRICITY IN PARIS.—The French Minister of Posts and Telegraphs has appointed a special commission to study the organisation and the working of the Central Laboratory of Electricity. This commission is composed of the following gentlemen:—

Songeon, president du conseil municipal de Paris; Dumas, member de l'Institut, secrétaire perpétuel de l'Académie des Sciences; Alphand, directeur des travaux de Paris; Jamin, member de l'Institut; Le Colonel Perrier, membre de

l'Institut et du Bureau des Longitudes; Bréguet, membre de l'Institut et du Bureau des Longitudes; Tisserand, conseiller d'Etat, directeur au Ministère de l'Agriculture; Mascart, professor au Collège de France, directeur du Bureau Central Météorologique; Becquerel, ingénieur ordinaire des ponts et chaussées, répétiteur de physique à l'Ecole Polytechnique; Fournier, capitaine de frégate, attaché à l'état-major du Ministère de la Marine et des Colonies; Penel, commandant du génie, attaché à l'état-major général du Ministre de la Guerre; Mercadier, ingénieur-electricien, directeur des études à l'Ecole Polytechnique; Bergon, directeur du matériel et de la construction au Ministère des Postes et des Télégraphes; Blavier, directeur de l'Ecole Supérieure de Télégraphie au Ministère des Postes et des Télégraphes; Boussac, inspecteur-général chargé des services du contrôle au Ministère des Postes et des Télégraphes; Caël, directeur-ingénieur des Télégraphes; Georges Cochéry, directeur du cabinet et du service général au Ministère des Postes et des Télégraphes; Fribourg, directeur du personnel au Ministère des Postes et des Télégraphes; Raynaud, ingénieur des Télégraphes; Trotin, ingénieur des Télégraphes.

Tenders for the Supply of Telegraph Material.—We read in the *Moniteur des Adjudications de l'Etat*, that the French Telegraph Administration invites tenders for the supply of the following instruments, stores, &c., the adjudication of which will take place on the 22nd inst., viz.:—

1. The supply of sending and receiving telegraph instruments divided in 16 lots, composed of 60 Hughes' instruments, 1,800 Morse receivers, 8 transmitters, 8 receivers, and 80 Wheatstone perforators, 1,400 sounders, 1,500 electric bells, 2,200 detectors.

2. The supply of additional apparatus for telegraph offices, divided in 10 lots, and composed of 1,700 Morse keys, 3,700 commutators, 800 bell pushes, 4,400 lightning protectors of various systems, 1,200 paper-wheels, 15,000 brass-screw terminal, 25,000 brass strips for table connections, 6,000 battery terminals, 10,000 ebonite case pieces (socles), 20,000 ebonite washers, and 400 oak boxes.

3. The supply of materials and chemical productions for batteries, divided in nine lots, and composed of 46,000 glass jars of various models, 60,000 porous pots, 172,000 various zinc pieces for batteries, 10,000 kilogs. of bi-oxide of manganese, 10,000 kilogs. of chlorhydrate of ammoniac, 90,000 kilogs. of sulphate of copper, 8,000 kilogs. of pounded retort carbon, 4,000 kilogs. of dextrine, 70,000 prisms of retort carbon, and 3,000 kilogs. of copper wire of ·08 diameter.

Further particulars may be obtained from the Administration, 103, Rue de Grenelle, Saint Germain, Paris.

The Maxim Incandescent Electric Lamp.—We believe that this light has been withdrawn from the General Post-office at Glasgow, amid universal grumbling on the part of the men. We hear various rumours to account for this, and from what we can understand the matter is apparently a personal one. The blame however will doubtless be cast upon the electric light in some form or other.

The Electric Lighting of Theatres at Paris.—After the recent experiments of electric lighting made at the Théâtre des Variétés, M. Bertrand has determined to light his house for a whole season, from September, 1882, until June, 1883, by incandescent lamps. After this long trial, electric lighting will be used permanently or discontinued. The other directors of the theatre await the results of this innovation before making a decision. Meanwhile, the manager of the Eden Theatre, at present in course of construction, has determined to adopt electricity for the complete illumination of the theatre, making use of the voltaic arc and incandescence, by means of Maxim lamps and Kabath accumulators, charged from the necessary apparatus placed in the basement of the Eden. The experiments in preparation are, therefore, very interesting, and we will follow their development carefully.

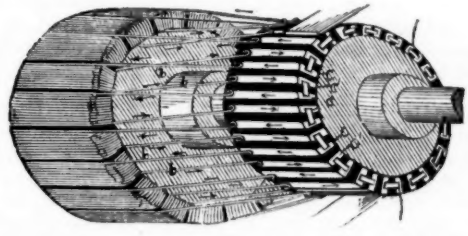
The Electric Light at Liverpool.—We hear that the Pilsen electric light, to which we alluded last week, has been used with great success at the Adelphi Hotel. Three large burners in the great ball-room, and another in the hall, have shed a brilliant radiance on the illustrious guests who have been in the city recently in connection with the International Law Conference.

The Brush Midland Electric Light and Power Company, Limited.—This Company has received an order to light up the factory of Messrs. Birkin Brothers, the well-known lace manufacturers of Nottingham, with Brush arc and Lane-Fox incandescent lamps.

At Gainsborough the same company, in compliance with the request of a number of the leading inhabitants of that town, who undertook to defray all expenses, has during the past fortnight very successfully illuminated the market-place with Brush arc lamps, and also exhibited Lane-Fox incandescent lamps in the shop of one of the principal tradesmen. Both the arc and incandescent lamps were run on a single circuit from the same machine, and were proved to be under perfect control. Numerous applications for electric lights—especially for the Lane-Fox lamps—have, we understand, been received by the company.

The Cost of the Electric Light at Edinburgh.—The abstract of the Edinburgh Police accounts, just issued, shows that for the "experimental electric lighting" of the North Bridge, Waverley Bridge, and Princes Street, on the "Brush" system, from the 25th August, 1881, to the 2nd January, 1882, the city paid the sum of £1,181 4s. 8d.; and for a trial of the "Crompton" at Holyrood Palace, August 25th, to September 8th, £57 13s. 7d. Expenses of deputations to London bring up the total cost to £1,265 1s. 3d. The sum of these experiments is made up as follows:—Fitting up engine-house, electrical machines, &c., £115 0s. 6d.; Furnishings to engine-house, machinery, coals, and firewood, £170 15s. 9d.; Wages of watchman, and attendants at machines and lamps, £39 16s. 3d.; Lamp pillars and bases (pillars, £209; stone bases, £62 8s.; mason work at lamps, £10 6s. 8d.), £281 14s. 8d.; Electric lighting (the Anglo-American Brush Electric Light Corporation, Limited, 25th August, to 30th November, 1881, £389 10s.; the Scottish Brush Electric Light and Power Company, Limited, 3rd December, 1881, to 2nd January, 1882, £184 7s. 6d), £573 17s. 6d. Total, £1,181 4s. 8d. At Holyrood: Fitting up lamp poles, £17 13s. 7d.; The Crompton Electric Lighting Company, for electric lighting, 25th August to 8th September, 1881, £40. Total, £57 13. 7d. General Expenses: Expenses of deputations to London on experimental electric lighting, May and June, 1881, £26 3s. Total cost, £1,265 1s. 3d.

Commutator for Dynamo-Electric Machines.—Patent No. 261,520. Filed in the United States of America Patent Office, February 15th, 1882.—By R. Edward Ball.



Claim.—1. An armature for dynamo-electric machines, having each end of every bobbin thereof connected to a separate block in the commutator ring and such blocks coupled together in pairs, so that a current generated in one of said bobbins must pass to and through a pair of commutator-blocks before passing to a succeeding bobbin, substantially as shown and described.

2. In combination with an armature of a dynamo-electric machine, a commutator therefor having twice as many blocks as there are bobbins or sections on the armature-ring, so as to provide for each end of every such section being connected to a separate commutator-block, such blocks being coupled in pairs, substantially as shown and described.

3. An armature for dynamo-electric machines, the bobbins or sections whereof are disconnected from each other, each end of every bobbin being connected to a separate block in the commutator, such blocks being coupled together in pairs, and thereby forming an indirect connection for said bobbins, substantially as shown and described.

THE EDISON LIGHT IN ITALY.—We have received notice that Mr. Shepherd, the agent of the Edison Company in Italy, has succeeded in forming a syndicate of the principal bankers in Milan for the purpose of working the Edison patents in Italy. Mr. Shepherd remains with them as agent-general. This gentleman has just been lighting up a portion of Udine with the Edison light, which has proved such a success that he is preparing a contract for lighting the whole of the city. The motive force will be supplied by the River Ledra. The cities of Mortara, Pistoja, Faenza, Fano, Arezzo, Schio, and several others are also to be lighted by this system, and in Milan the theatre Santa Radegonda has been purchased for a lighting station, and part of La Scala theatre will be illuminated during the Carnival from it, and the principal shopkeepers have ordered their shops to be lighted—one firm alone having ordered 1,200 lamps.

THE COST OF THE ELECTRIC LIGHT.—We notice that Lieutenant-Colonel Festing reports that the substitution of electric lighting, by the aid of two machines driven by one engine, in the place of gas, at the South Kensington Museum, has resulted in a saving in the working expenses at the rate of nearly £750 a year, or more than £23 per annum for each lamp.

COPYRIGHT AND ELECTRIC LIGHT COMPANIES.—A motion was made in the action of "The London and Provincial Electric Lighting and Power Generating Company (Limited) *v.* The West Middlesex Electric Lighting Company (Limited)," to restrain the publication of a prospectus which the plaintiffs alleged was a copy of one which they had issued, and in which they had copyright rights. Mr. Ribton, for the plaintiffs, said since the matter was last before Mr. Justice Chitty the defendants had filed an affidavit stating that they had discontinued the issue of the prospectus in question, and had no intention of reissuing it. Under these circumstances, he asked that the motion should stand over until the second motion day in November. Mr. Marten, Q.C., acquiesced in the suggestion, and the motion, without prejudice, stands over accordingly.

THE SCOTTISH BRUSH ELECTRIC LIGHT AND POWER COMPANY (LIMITED) IN LIQUIDATION.—Intimation is given that all claims against this company must be lodged, duly vouched, with Mr. Jas. A. Molleson, 5, North St. David Street, Edinburgh, on or before Wednesday, the 23rd inst.

TELEGRAM FORMS.—F. H., in a letter to the *Times*, suggests that telegram forms should be supplied with a gummed flap, so that they might be folded and delivered sealed at the office for transmission, thereby doing away with the disadvantage of submitting the message to the perusal of the messenger.

THE NEW CABLE TO PORT SAID.—On Friday last Mr. John Pender, M.P., received a telegram from the Eastern Telegraph Company's agent announcing the completion of the new telegraph line to Port Said. The promptitude with which the work has been carried out reflects great credit on all concerned.

CENTRAL AND SOUTH AMERICAN TELEGRAPH COMPANY.—The India-rubber, Gutta-percha and Telegraph Works Company notify the receipt of a telegram from Mr. R. K. Gray, engineer-in-chief, stating that the ss. *Silvertown* had successfully completed, on the 10th inst., the San Juan del Sur-Pedro Gonzales section of the Central and South American Telegraph Company's cables.

This section was the last one to be laid, and the company's system on the West Coast of Central and South America, from Chorillos (Peru) to Salina Cruz, Tehuantepec (Mexico), is therefore now completed. On the Atlantic side the Goatzacoalcos-Vera-Cruz section connects this company's system with the Mexican Telegraph Company's cables from Vera-Cruz to Galveston, and an excellent communication is now established between the republics of Chili, Peru, Ecuador, U.S. of Columbia, Nicaragua, San Salvador, and Mexico, and the U.S. of North America. We notice in the Panama *Star and Herald* of June 22nd the following interesting items relative to the operations of the above-named company :—

"The cable steamer *Retriever* has been occupied the past two days in laying the shore end of the cable which is to place us, at an early date, in communication with the outside world. The place at which the cable was landed is about a couple of hundred yards to the eastward of the point where the road leading past the cemetery comes out on the beach. From deep water it is laid entirely in a mud or sand bottom to where it is now located. Great care was exercised in selecting the place, so that no rough or jagged rocks would be met with which would chafe or injure the cable in any way. In order to make connection with the cable now buoyed off Pacheco, one of the Pearl Islands, the *Retriever* will continue the work, laying the cable inside of Taboga and other islands, and on bottom not likely to be disturbed by vessels coming to an anchor in the port or at Taboga. The connection at Pacheco will probably be made to-day or to-morrow, when the *Retriever* will return to Taboga.

"Yesterday the connection was made between the shore section of the cable at Panama and the line buoyed off the island of Pedro Gonzales, one of the Pearl Island group. The *Silvertown* picked up the buoy behind Taboga, to which the cable was attached, and got under weigh about eight o'clock, completing the run down to the Pearl Islands and splicing the cable in a few hours from the time of starting. From the station on shore signals were exchanged with the *Silvertown* at the Pearl Islands, and to-day the line thus completed will be tested through to Lima.

"In response to the courteous invitation of Mr. J. B. Poylo a number of our principal townspeople visited the cable ships *Silvertown* and *Retriever* on Sunday, the 18th inst. The steamer *Taboguilla* took the invited guests on board in the morning, sailing about eight o'clock, calling at the island for some other guests, and arrived alongside the *Silvertown* about eleven o'clock. The two ships were lying side by side, and were gaily decorated for the occasion. A sumptuous lunch was served on board, after which dancing was indulged in until the hour for return was notified. The band of the 1st Battalion of Zapadores furnished the music for the occasion, through the kindness of General Capella Toledo, who was among the visitors. The excursion was in every respect a great success, and the ladies and gentlemen enjoying it express unqualified praise of the kindness and courtesy of the officers of the two cable ships and the other gentlemen connected with the expedition.

"The Cable ships *Retriever* and *Silvertown* will sail to-day for the Coast of Central America. They will leave the line connected as far as Panama, where it will be completed to the station in a few days and tested for any defects which may exist between here and Buenaventura. The two ships will call at San Juan del Sur in Nicaragua, and at La Libertad in Salvador, or San José de Guatemala, laying the shore sections, if the weather is good. Proceeding thence to Salinas Cruz the line will be landed and then run down along the coast, making connections with the various shore sections until the island of Pedro Gonzales is reached, where the last splice will be made and the work completed. The T. line to Panama is shorter than was originally intended. It was discovered that the depth of water across the entrance to the bay was much greater than was supposed, being in some places over 2,000 fathoms. The bottom shelves off very abruptly in places a short distance below the Pearl Islands. Lines of soundings made across the bay present some remarkable differences in depth, in some instances soundings a mile apart giving a difference of 1,000 fathoms. Soundings about 8 miles South of the Pearl Islands and North of Cape Malo gave as much as 1,800 fathoms of water, while a little further South a depth of 2,004 fathoms was reached. As the contract provided that the cable should be laid in water not over 400 fathoms deep, the original course has been abandoned, and the line of the coast has been followed, keeping to a uniform depth of water. This plan, it is believed will make the work of repairs in the future a matter of much less difficulty than if the cable had been laid in very deep water. The bottom discovered along the coast presents the same general features, and is principally a dark greenish coloured mud, in which the cable will rest with perfect safety. A vast number of specimens of this muddy deposit have been secured and chemically tested, showing, we believe, few or no traces of copper, iron pyrites, or other mineral agents whose effects on the steel sheathings of the cables are most destructive."

Submarine Telephone Experiments.—Recently experiments have been conducted at Havre with a view of establishing telephonic communication between vessels and the shore. From the reports which have reached us it would appear that the operations have been attended with a large measure of success. In spite of rough weather the cable was successfully laid, and various persons and offices in the town were put in connection with the vessel anchored at nearly a mile distant from the premises of the Marie Christine Club. The Ader and Crossley instruments were used, and conversation was very distinctly maintained, notwithstanding the heavy gale, which caused the vessel to roll considerably.

This new application of the telephone will render important service to maritime commerce, since it will allow vessels arriving at a port to place themselves immediately in direct communication with owners or agents ashore. As a result of the successful experiment above referred to, a proposal to form a pontoon structure, to be moored at a distance from the land, on board of which public telephones should be placed for use by ships has already been mooted at Havre.

The United Telephone Company.—This company is now becoming most energetic. A circular has been sent to its various subscribers couched in these terms :—

Sir,—Will you kindly furnish us with the names of any firms, friends of yours, who are not connected with our Telephone Exchange system, so that we may put ourselves in communication with them, with a view to extend our system, in order that it may be of greater service to yourselves and to our subscribers generally ?

Your obedient servant,

THOMAS BLAIKIE, Secretary.

The self-sacrificing motive of the company in its consideration for its present subscribers will no doubt be duly appreciated.

The Suez Canal and Telegraphic Extension.—A Lloyd's telegram from Port Said dated August 15th, 2.15 p.m., states that the Suez Canal continues free. M. de Lesseps is reported to be impeding the extension of the new telegraph system from Port Said to Suez. The laying of that portion of the line, which would form a valuable connection with our Indian system, is, therefore, for the present suspended. The Eastern Telegraph Company have permission from the Khedive and the Suez Canal Company at Paris to lay the lines ; but this is ineffectual against the obstacles put in the way of the work at the Canal by M. de Lesseps.

The Government and the Telephone.—In a letter to the *Times*, dated the 14th inst. and signed "Electrician," the writer, in referring to Mr. Fawcett's statement in Parliament, says :—

The public could scarcely imagine from this statement that the Post-office taxes the telephone companies to the extent of at least £2 for each subscriber to central office systems. This is equal in London on 2,000 subscribers to £4,000 per annum. How, in face of this fact, Mr. Fawcett can talk of free competition between the companies and the Government is simply inconceivable.

Again, under the Post-office Acts, the Government can fix their poles or wires in or on any person's premises (even in your front garden, if they like), and all the aggrieved owner can do is to claim compensation at the hands of an arbitrator. As a matter of fact, from being Governmental, the Post-office gets most of its permissions for practically nothing.

The telephone companies on the other hand, have no such powers, but must negotiate for each permit, and pay whatever is demanded, and often very extravagant the demands are. Tenants, as well as proprietors, have frequently to be settled with likewise.

Unless, therefore, the Government are prepared to surrender their tax and to give the companies the same statutory powers it is a farce to talk of free competition with the Post-office.

The Storm on the 13th of August at Paris.—A violent storm broke over Paris last Sunday at four o'clock in the morning, where it has done considerable damage. In the garden of l'Elysée, the residence of the President of the Republic, the lightning has struck a tree and stripped off the bark from top to bottom. In front of the Hôtel Dieu it struck the lamp of a carriage, and reduced it to atoms without the coachman and a passenger who occupied the vehicle feeling anything. We may add to these depredations the destruction of the roof of a house and the burning down of a cart-shed. Six women occupied in a washhouse were knocked down by the storm without any injury, but in the Boulevard de Belleville a woman was dangerously burnt on the face, and was conveyed to the Hospital of Saint Louis in an alarming condition.

Telegraphs in Turkey.—The Turkish Government has issued a new tariff for telegraph messages. According to an imperial irade, given on the proposal of the General Administration of Posts and Telegraphs, and on the advice of the State Counsel, confirmed by the Counsel of Ministers, the internal telegraph service will henceforth be managed according to the rules of the Telegraph Convention of St. Petersburg and as revised at the conference in London.

One of the principal rules of this regulation is the taxation per word, with an *appoint* of five words, which forms the price, properly called, of the telegram. The charge per word is fixed for the whole of Turkey at 20 paras for telegrams exchanged between telegraph stations situated in any one and the same province, and at 40 paras for telegrams forwarded from one province to another, either near or far off.

This new tariff realises an exceptionally favourable condition for the development of the telegraph service in Turkey.—*La Lumière Electrique.*

On the Variation of Friction produced by Voltaic Polarisation.—By M. Krouchkoll.—The electromotograph of Edison has drawn the attention of physicists to a novel fact, that of the variation of friction between a metallic surface and an electrolyte when a current is passed between the two rubbing surfaces. M. Koch published in 1879 an Investigation (*Wiedemann's Annalen* 1879, p. 92), in which he shows that polarisation by oxygen alters the rubbing surface of the platinum or palladium in such a manner as to increase the friction. Polarisation by hydrogen produces, according to this author, no effect. I have resumed these experiments under different conditions and have shown that polarisation by oxygen increases the friction, whilst polarisation by hydrogen decreases it. The electromotive force of half a Daniell is sufficient to demonstrate the phenomena. The decrease of friction by negative polarisation and its augmentation by positive polarisation increase with the electromotive force displayed.—*Comptes Rendus.*

On the Amplitude of Telephonic Vibrations.—By M. G. Salet.—Every one knows that it is possible to hear through a fir-wood door of little thickness words spoken in a room otherwise entirely closed. In this case, the sonorous vibrations transmitted by the air shake synchronously the side of the wood, and this in turn transmits its motion to the external air just as a movable piston might do. This familiar experiment ought, it may seem, to have struck physicists, since it gives a proof of the sensibility of the ear. The vibrations of the wood are, indeed, very small, scarcely larger than those of the receiving membrane of a telephone when in action, but these latter are so slight that their very existence has sometimes been called in question. They exist, however, and I am about to give an idea of their amplitude. I fixed upon the iron diaphragm of a hand-telephone of Bell's system a small disc of glass, weighing 0·45 gram. Opposite this I fixed a second, yielding with the former, Newton's rings. The apparatus, as will be seen, resembles that which M. Fizeau devised for studying expansions. If we speak at the distance of five to six metres from the telephone, or if we direct against it a telephonic current produced by means of a good transmitter (that of Boettscher, for instance, which does not require the use of a battery), we see the rings lose their distinctness and disappear if the voice is raised a little. They vibrate, in fact, themselves, synchronously with the iron diaphragm, and nothing is more simple than to calculate the amplitude of the vibrations of the diaphragm from that of their oscillations.

It is certain that the additional weight of 0·45 grams placed upon the diaphragm, must render its movements somewhat less extensive ; hence the results obtained fail rather on the side of deficiency than of excess.

To value the displacement of the rings, we arrange before the telephonic receiver, into which a continuous sound is emitted, a turning disc pierced with slits. It

is found that at a certain speed of rotation the rings reappear distinctly. If we then blow across the disc, making it act a siren, we find that the sound produced is in unison with that transmitted by the telephone. If it lowers or rises slightly, the rings oscillate, at first slowly and then with such a rapidity that they again become invisible. Whilst they oscillate, this displacement may be easily estimated. In an experiment made, the amplitude of the vibrations of the receiving plate was from two to three ten-thousandths of a millimetre.

If we throw into the telephone currents of different intensities, but very small, and none of which produces a displacement of the rings beyond half the distance which separates them, we may, by considering a point of the glass plate infer from its brightness the intensity of the current. This singular galvanometric procedure might, without doubt, be utilised in a telectroscopic receiver.—*Comptes Rendus.*

ON THE CHEMICAL WORK EFFECTED BY THE BATTERY.—By M. D. Tommasi.—An element with a mixture of chromic and sulphuric acids should evolve, according to Favre, 117·3 calories, though only 62·5 calories are transmissible to the circuit. It would then result that a single chromic acid element would not decompose water acidulated with sulphuric acid.

In fact, if the positive electrode of this element is of platinum the water is not decomposed; but if the electrode is of carbon or of platinum sponge, electrolysis takes place. The chemical reaction produced within the element being always the same, I have sought to determine approximately, by means of electrolysis, what is the number of calories transmissible to the circuit by a chromic acid element, according as its positive electrode is of platinum, of carbon, or of platinum sponge.

(*a.*) *Chromic Acid Element with a Platinum Electrode.*—This element does not decompose water acidulated with sulphuric acid if the electrodes of the voltameter are of platinum, but the decomposition takes place if the positive electrode is of silver. A chromic acid element and a Regnault element decompose water with platinum electrodes to the voltameter.

A chromic acid element decomposes the water contained in two voltameters if the two positive electrodes are one of silver and the other of copper. Hence the electromotive force of this element must be intermediate between 62 and 69 calories. The number of calories transmissible to the circuit, as given by Favre, 62·5, thus closely approaches that found in a different manner. It is a singular fact that an element which liberates 117·3 calories should not transmit to the circuit in the form of electric energy more than 70 or at most 72 calories, as otherwise it would decompose water acidulated with sulphuric acid. I will return to this question when speaking of an element with oxygenated water which presents the same anomaly.

(*b.*) *Chromic Acid Element with a Carbon Electrode.*—The water of the voltameter being acidulated with sulphuric acid, there is electrolysis either with both electrodes of platinum, or with a negative electrode of platinum and a positive of copper. This element, if associated with a zinc-platinum element in dilute sulphuric acid, ought to decompose if its electromotive force is really = 117·3 calories. These experiments show that the electromotive force of the chromic acid element with a carbon electrode should not be less than 82, nor greater than 90 calories.

(*c.*) *Chromic Acid Element with an Electrode of Platinum Sponge.*—The chemical work produced by this element is sensibly equal to that produced by the former element, whence its electromotive force should be estimated at about 8 (85 ?) calories.

It results from these experiments that the chromic acid element, as employed by Favre—that is to say, with a positive electrode of platinum—only produces an exterior chemical work of 65 calories.

If we substitute for platinum in the same element carbon or platinum sponge, we may render 85 calories transmissible to the circuit.

If we compare the electromotive forces of chromic acid elements as determined by means of physical procedures, we find, according to the nature of the positive electrode, the following values:

Carbon = 1·574, platinum = 0·977, copper = 0·961, platinum sponge = ?

The decrease of the electromotive force observed in the chromic acid element with a copper electrode is because this metal being attacked by the mixture of chromic and sulphuric acid, even if the circuit is open, occasions a current in the opposite direction to the primary one. As for the electromotive force of the chromic acid element with an electrode of platinum sponge, it has not yet been determined; but we may foresee, according to what has been said, that it will probably be very near to the electromotor force of the chromic acid element with a carbon electrode.—*Comptes Rendus.*

ON THE CHARGE OF DIELECTRICS.—By MM. Villari and Righi.—Villari had observed that on lashing one side of an ebonite plate it was charged, as is generally known, negatively, whilst the other side without contact with a conductor took a positive charge, the opposite of what is generally supposed. Righi, on the other hand, found that the latter charge only appears after the lapse of some time and is therefore secondary. On repeating the experiments together, when the anterior surface was rubbed with cat-skin and then laid upon a plate which had been previously discharged, the lower surface when examined by means of a mixture of red lead and sulphur or of a test-disc was generally found positive. If the experiment is performed rapidly or if the ebonite plate is heated or thoroughly dried over chloride of calcium it appears negative. If exposed for some time to the air it is positive again. The latter charge is therefore secondary.—*Wiedemann's Beiblätter.*

ON THE LUMINOUS AND SPHEROIDAL PHENOMENA WHICH ACCOMPANY THE ELECTROLYSIS OF LIQUIDS.—By M. Slouguinof.—It has long been known that under certain circumstances electrolysis is accompanied by luminous phenomena at the electrodes, but these appearances have till lately remained almost unnoticed. It has been established that light appears at the electrode with which the circuit of a battery of many elements is closed by plunging it into an electrolyte already connected with the other pole of the battery. The author has found that if two equal electrodes are plunged unequally deep into the electrolyte, on closing the circuit of a sufficiently powerful battery a luminous phenomenon appears at the electrode which is less deeply immersed. This electric luminosity may be of two kinds, one of which is a consequence of the spheroidal state which the liquid assumes at one of the electrodes in consequence of the action of the current. Just as metal when raised to a high temperature repels any liquid which is brought in contact with it, so a liquid is repelled by a metal which is being traversed by a powerful galvanic current; in other words, both heat and electricity can throw a liquid into the spheroidal state. Both these agencies may occasionally act conjointly. The electro spheroidal condition is accompanied by a faint luminous appearance. Besides this electrolytic light there is also a luminosity of another kind, and if it takes place at the cathode, particles of platinum are detached from this electrode. In case of the development of light at the cathode and in a solution of platinum chloride in hydrochloric acid, the intensity of the light depends on the heating of the platinum powder which is there separated.—*Carl's Repertorium der Experimental Physik.*

A GALVANIC ELEMENT.—By C. Baudot.—The author modifies a Bunsen element by using, instead of one earthenware cylinder, two, the one placed in the other, both filled with nitric acid. The carbon is placed in the interior vessel.—*Wiedemann's Beiblätter.*

IMPROVEMENTS IN SECONDARY GALVANIC BATTERIES.—Amongst the many practical or unpractical proposals for the construction of secondary batteries, must be included the following:—

The electrodes, formed of spirally-coiled polished plates or wire brushes, *e.g.*, of silver, plunge into a vessel filled only to a little depth with water, but chiefly with oil. The oil is to form a badly conductive coating upon the electrodes, so that the cell may charge itself electrostatically. For the electrodes may be substituted baskets filled with coke, or two strata of coke separated from each other by wadding.—*Wiedemann's Beiblätter.*

NEW PATENTS—1882.

3779. "Electric lamps." B. J. Mills. (Communicated by W. M. Thomas.) Dated August 9.

3795. "Electric lamps or lighting apparatus." W. R. Lake. (Communicated by J. B. Wallace.) Dated August 9. *Complete.*

3802. "Secondary batteries." C. T. Kingzett. Dated August 9.

3803. "Telephonic apparatus." S. P. Thompson. Dated August 9.

3812. "Electric secondary or storage batteries." J. S. Beeman, W. Taylor, and F. King. Dated August 10.

3813. "New apparatus for regulating and measuring electric currents." J. S. Beeman, W. Taylor, and F. King. Dated August 10.

3814. "Electric lamp apparatus." H. J. Haddan. (Communicated by C. F. Brush.) Dated August 10.

3815. "Improvements in type-writers and in the method of producing symbols by the same; also applicable to printing telegraphs." H. J. Haddan. (Communicated by B. Schmitz.) Dated August 10.

3820. "Magneto-electrical apparatus for signalling on railways." J. H. Johnson. (Communicated by F. and J. Ducousso and the Société Anonyme Maison Breguet.) Dated August 10.

3821. "Electric lamps." F. Mori. Dated August 10.

3822. "Batteries for the storage of electricity." F. Mori. Dated August 10.

3824. "Meter or registering apparatus for the electric light." A. M. Clark. (Communicated by L. Hours-Humbert and J. de B. de Liman.) Dated August 10.

3825. "Electro-motors." S. H. Emmens. Dated August 10.

3827. "An improved vessel or station for automatically compressing and storing air by the action of the waves of the sea, and also for the generating of electricity by means of this compressed air." C. W. Harding. Dated August 10.

3834. "Regulating electric light." H. Wilde. Dated August 11.

3842. "Suspending telegraph wires from iron posts." H. C. Jobson. Dated August 11.

3846. "Regulating electric currents." W. S. Smith. Dated August 12.

3856. "Electric lamps or lighting apparatus." W. R. Lake. (Communicated by N. E. Reynier.) Dated August 12.

3861. "Electric incandescent lamps." G. Pfannkuche and A. A. Dixon. Dated August 12.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1881.

5668. "Dynamo-electric machines, &c." Sir William Thomson. Dated December 26. 1s. 10d. Consists of improvements in dynamo-electric machines, and which may be employed either for generating electric currents, or for developing mechanical energy from electric currents. One of these improvements consists of a revolving metallic brush, to perform the functions of the fixed metallic brushes or combs which have been hitherto generally used for making the contacts with the commutator bars. By means of this brush the desired effect is produced with but little friction, the mechanical action being chiefly rolling. The requisite rigidity, or quasi-rigidity of the roller is given partly by the elasticity of its constituent metallic parts, and partly by centrifugal force. [This is an important patent.]

1882.

14. "Apparatus for electric lighting." Andrew Mackie. Dated January 2. 6d. Relates to an improved incandescent lamp constructed with two or more filaments enclosed in an exhausted glass globe, and to which there is connected a regulating arrangement whereby any surplus currents of electricity over and above that required to make a single filament incandescent is shunted into the next filament or filaments, according to the strength of such excess of current, thus preventing any one of them being overheated and destroyed, and admitting of the illuminating power of every lamp in a circuit being increased by simply increasing the main current to a suitable extent. In carying out this invention the inventor proceeds as follows. All the positive terminals of the filaments in the globe are connected to studs let into a piece of insulating material, the studs being fixed at a certain distance apart; the branch positive conductor from the main lead being attached to the first of the studs. On the first stud there rests a sliding contact piece of such size and shape that when moved to the necessary extent it can cover and make contact with the whole of the studs. This contact piece is attached to a spindle connected to the armature of an electro-magnet, a small spring being arranged so as to press the armature away from the magnet. When a normal current on its way to stud No. 1 passes round the coil of the electro-magnet, this latter overcoming the pressure of the spring attracts the armature and so draws the contact piece into close proximity to the second stud; but should an excess of current occur either accidentally or intentionally, such excess over and above the normal current will draw the armature still closer to the magnet, and so cause the contact piece to slide over and make contact with one or more studs according to the amount of such excess of current, thus throwing the corresponding filaments into action.

29. "Secondary batteries." D. G. FitzGerald and C. H. W. Biggs and W. W. Beaumont. Dated January 3. 2d. Relates to the improvement of secondary electrical batteries. According to one part of the invention electrodes are obtained having an increased surface or porosity by utilising what is known as local action occurring between lead and a metal electro-negative to lead. The electrodes are obtained by depositing on or in plates of lead or of lead alloy by chemical, electro-chemical, or mechanical means, a metal electro-negative to lead, such metal being in most cases subsequently removed preferably by making the plate an anode in a solution which does not form a soluble salt of lead. (*Provisional only.*)

49. "Measuring and recording quantity of electricity," &c. John Hopkinson. Dated January 4. 6d. Relates to the methods of measuring the whole quantity of electricity which passes through a conductor. For this purpose the inventor makes use of a centrifugal governor or centrifugal apparatus and controls its velocity by electrical or electro-magnetic apparatus. The centrifugal force of the governor may be opposed by the attraction or repulsion of one conductor conveying electricity on another conductor conveying electricity, of an electro-magnet for its armature or of a solenoid for its core. Or the centrifugal force may move one contact piece or its equivalent and the electrical apparatus a second contact piece in such wise that as the speed of the governor increases the former piece or its equivalent is moved from the second whilst as the electrical force increases the second piece follows up the first. When the centrifugal force is mechanically opposed to the electrical force the governor may act by bringing a friction brake into action or it may act by making and breaking an electrical contact. The governor may be driven by a small dynamo-electric machine or in the case of using a brake the governor may be driven by clockwork.

55. "Apparatus used in the distribution of electrical energy." John Perry. Dated January 5. 4d. In the distribution of electrical energy from a central source it is very important that any person to whose premises conducting wires are laid should get a supply which is quite independent of the demand from and supply to other consumers of power. The inventor's method is to use one or more magneto-electrical machines or some other form of electrical machine or battery which will produce in a circuit an electromotive force which is constant and independent of any other electromotive forces in the same circuit, and in addition to this to have in the same circuit one or more dynamo-electric machines.

64. "Magneto and dynamo-electric machines." Lorentz Albert Groth. (A communication from abroad by R. J. Gülcher, of Austria.) Dated January 5. 6d. Has for object the reduction or obviation of the injurious heating of the wire coils, and thereby the production of an increased useful effect in the machine. According to these improvements the inductor rotating between the magnetic pole surfaces consists of a ring, the core of which is formed of separate magnetically insulated strips (Lamellen) of soft iron in order to facilitate the change of the magnetic poles during the rotation of the ring, and thus to reduce the heating of the ring itself to a minimum. The section of the ring differs materially from those of other machines, being either of a wedge shape, that is, triangular, or of a wedge-shaped pointed square or rectangle. This form not only permits of a convenient and solid fixing of the inductor, but also allows the wire bobbins wound round such a ring to be exposed to the inducing action of the magnetic pole surfaces from all sides, and thereby completely obviates the production of heat, which in other machines is formed in the passage of the electric current through the unexcited wire parts. The magnetic pole surfaces are formed in all their parts of a U-shaped section, and enclose the rotating ring in such manner that the legs of its cross section project out on both sides over the wedge-shaped points of the section of the ring, and the latter is thus exposed on all sides to their inducing action.

69. "Manufacture of incandescent lamps." E. H. T. Liveing and C. V. Boys. Dated January 6. 4d. Relates to modes of manufacturing incandescent lamps, whereby their expense is reduced or their conducting threads more easily replaced when damaged or destroyed. In the first class of lamp, where cheapness is obtained, the inventors avoid the use of the platinum wires sealed in the glass which have hitherto been employed in vacuous lamps to make electrical connection with the carbon thread and the wires outside, and use instead a pair of conducting wires, suitably insulated, passing through a narrow tube or tubes sealed on to the globe, and they prevent the entrance of air into the globe through the tube by partly filling it with well-boiled pitch, or other resinous or suitable cement, which will not give off sufficient vapour to injure the lamp.

71. "Automatic electric-printing registers, &c." A. J. Boult. (A communication from abroad by B. E. Valentine, of New York, America.) Dated January 6. 10d. Consists of automatically receiving and forming a permanent register of electric signals. It consists of one or more transmitters, or signal boxes, for sending signals by the breaking of a circuit. The chief features of the signal-box being a revolving wheel, having on its first quarter the notches to denote the nature of the signal. On the next quarter and on the third quarter notches to denote the number of the station whence the signal is sent, and on the last quarter an independent contact surface to switch a main circuit through a bell magnet to enable a return signal to be sounded at the transmitter.

72. "Secondary or reversible electric batteries." Rankin Kennedy. Dated January 6. 2d. Has for its object to improve the construction and action of secondary or reversible electric batteries. A battery made according to the invention consists of one or more vessels, each of any convenient shape, made of wood or other suitable non-conducting material, and capable of holding a quantity of dilute sulphuric or other suitable acid. Immersed in the dilute acid there are plates of lead, tin, iron, or other suitable metal, or of conductiug carbon, prepared in such manner as on being charged by an electric current from

a dynamo-electric machine or other source to become the receptacles of oxygen and hydrogen due to the decomposing action of the current, the oxygen being absorbed in, or in connection with, one kind of plate, and the hydrogen in, or in connection with, another kind of plate. After being charged in this way the battery is capable of being used to supply an electric current. (*Provisional only.*)

95. "Electric lamps." W. J. MACKENZIE. Dated January 7. 6d. Relates to improvements in, or connected with, electric arc lamps, which consist (firstly) in special means whereby the feeding of the carbon pencils or electrodes is controlled, and their resistance minimised; and (secondly) in novel arrangements of regulating appliances connected with electric arc lamps, to be used either in combination with, or separately from the first part of the improvements, whereby more perfect regulation of the distance between the electrodes may be secured for the purpose of maintaining the arc steadily.

118. "Telegraphy." PETER JENSEN. (A communication from abroad by F. W. Jones, of America.) Dated January 9. 4d. Relates especially to duplex cable telegraphs, and the object is to provide an efficient means for overcoming the disturbing effects of the electrical discharge from the cable upon the receiving instrument at the home or sending station. (*Provisional only.*)

120. "Storing Electrical Energy, &c." J. E. LIARDET. Dated January 9. 8d. Has for its object improvements in the means of and in the apparatus for storing electrical energy and in the preparation of the materials to be employed.

129. "Electrically lighting railway trains." W. H. PREECE. Dated January 10. 6d. Relates to the lighting of railway carriages by electricity, the object in view being to provide means of generating a practically uniform current of electricity notwithstanding the stoppage of the train or variations in its speed. For this purpose from one or more of the running axles of the train the inventors work air-compressing pumps, so as to charge one or more reservoirs with compressed air. This compressed air is employed to work an engine or engines which work suitable dynamo-electric machines, the air engines having their supply regulated so as to maintain as nearly as possible uniform speed.

144. "Secondary galvanic batteries." H. J. HADDAN. (A communication from abroad by Dr. Emil Boettcher, of Leipzig.) Dated January 11. 2d. Relates to secondary galvanic batteries or accumulators, and consists in the application of zinc vitriol as exciting liquid, and of zinc and oxide of lead as electrodes, the action of these elements being as follows:—An electric current from a dynamo-machine passing through a solution of pure sulphate of zinc (one part of the salt to three parts of water) decomposes the said salt, and causes a deposit of zinc on a thin plate of pure zinc, the diluted sulphuric acid (1 to 10) being not strong enough to attack pure zinc. The other pole is formed by thin lead foil, folded several times, in order to augment the active surface, and covered with a thick layer of pure litharge. The oxygen, coming in contact with the said lead foil, produces a very thin layer of peroxide of lead. By closing the galvanic element thus formed, the zinc previously deposited is again dissolved, and thereby the sulphate of zinc produced, while the hydrogen reduces not only the peroxide formed on the lead plate, but also a layer of the oxide of lead, thereby forming metallic lead. If now the current from the dynamo-machine is again passed through the element, a new deposit of zinc is formed on the zinc plate, while on the opposite pole not only the previously reduced peroxide of lead, but also the lead formed from the oxide, is again oxidised into peroxide of lead. By a few repetitions of this process, the secondary galvanic element is completed, and has acquired high electromotive power.

185. "Electric accumulators." H. J. HADDAN. (A communication from abroad by Augustin Morel, of Roubaix, France.) Dated January 13. 2d. Has for its object to reduce the weight of electric accumulators, and consists in the application of a series of receptacles provided with two metallic blades or other good conductors which serve as poles for the decomposition of water or other suitable liquid. If an electric current is made to pass through these elements, the receptacles are filed with gas, water yielding one volume of oxygen and two volumes of hydrogen. If now the current is broken or diminished, the oxygen combines again with the hydrogen to form water, thereby yielding the exact amount of electricity which has been previously spent. (*Provisional only.*)

197. "Apparatus for the transmission and reception of sounds." W. C. BARNEY. Dated January 13. 2d. In order to protect as much as possible a microphone or current regulator from the evil necessarily attendant upon the use of a thin vibratory plate in connection therewith, the inventor places the microphones inside a box made of wood, cork, ebonite, felt, or any equivalent material, the material surrounding the microphone being of sufficient thickness to reduce to a minimum any vibratory movements which the sound waves may give to the material, thus leaving the microphone to be acted upon by the molecular movement of the material to which it is attached. This box is not fixed to any substance, but merely rests on the top of a box containing the induction coil, where it is retained by its *vis-inertiâ*. (*Provisional only.*)

319. "Construction of secondary batteries." J. S. SELLON. Dated January 21. 2d. Relates to the construction of the terminal plates, supports, retainers, or frames upon or in which the active material or agent is deposited, placed, or fixed in the construction of secondary batteries, the object of the said invention being to render such plates, supports, retainers, or frames more durable than as they are now ordinarily constructed. In carrying out the invention the inventor constructs such plates, supports, retainers, or frames partially or entirely of pieces or rods of any convenient shape or combination of shapes of, or partly of, metal, carbon, or of other suitable material which is either conductive in itself or can be rendered conductive, on or to which are attached, connected, or affixed, strips or pieces of lead or other suitable metal or material, such strips or pieces being of any convenient form for retaining on the surfaces or in the cavities, interstices, cells, or spaces the active material in a divided, finely divided, pasty, deposited, or other convenient, or desirable condition.

224. "Electric-lighting apparatus, &c." W. R. LAKE. (A communication from abroad by J. S. Williams, of America.) Dated January 16. 6d. Relates to the manufacture or construction of electric lamps, candles, or lighting apparatus which will be more durable and efficient than those hitherto provided, and the said invention consists in various improvements as specified.

1437. "Electric accumulator." SIGISMUND COHNÉ. Dated March 25. 4d. Relates to a new or improved accumulator for the storage of electric energy (commonly called storage of electricity) for the purposes of electric lighting and electromotive power, whereby the inventor obtains a larger capacity of storage combined with greater efficiency and durability. Hitherto the cells of the accumulators in use are liable to polarise themselves and require a considerable volume and weight, or the electrodes are quickly destroyed. The object, therefore, of the invention is to obviate those defects, and also to simplify the construction of the accumulator whereby it is more readily applicable to different uses.

According to the invention, the inventor applies on the surface of a sheet of lead of any convenient size (by preference about a foot square and about 1-16th of an inch thick), a layer of mercuric sulphide, HgS, say, about six ounces to the square foot, whether amorphous or crystallised, by preference the crystallised HgS, called cinnabar or vermillion is used, and bends the coated sheet into the form of a box or into the form of a spiral, so that the layer cannot be removed by the acid. This prepared sheet is used for the positive electrode. A second sheet of lead rather less in size is arranged and prepared in the same way as the first one, for the negative electrode. Both sheets are perforated and placed so as to be separate or apart from each other into a jar or box filled with diluted sulphuric acid in the usual way, and then charged by the ordinary known process.

DISCLAIMERS.

The Edison Electric Light Company (Limited), "Electric lamps." No. 578. 1880. "Magneto-electric machines." No. 3964. 1880. "Connecting the carbon ends to conducting wires on electric lamps." No. 768. 1881.

CITY NOTES.

OLD BROAD STREET.

THE METROPOLITAN (BRUSH) ELECTRIC LIGHT AND POWER COMPANY (LIMITED).

ON the afternoon of Friday, the 11th inst., at the City Terminus Hotel, Cannon Street, under the presidency of Sir Michael Kennedy, R.E., K.C.S.I., an extraordinary general meeting of the members of this company was held.

The secretary, Mr. Robert Wilson, having read the notice convening the meeting

The Chairman said: This is a special meeting held merely for the purpose of confirming a resolution passed at the former special meeting. As soon as we have confirmed the resolution we shall be in a position to obtain from the Committee of the Stock Exchange a quotation. We have already, as you are aware, had a settlement. I therefore simply beg to move the following special resolutions, modifying the articles of association, duly passed at the extraordinary general meeting of the company held on the 24th July last be and the same are hereby confirmed:—

1. That the following words be inserted at the end of Article 4: "Provided always that no share shall be issued at a discount without the sanction of a general meeting."

2. That in lieu of "1886," occurring in Articles 81 and 89 respectively, "1884" be inserted.

3. That Articles 85 and 100 be and they are hereby expunged.

This was seconded by Mr. James Whitehead (vice-chairman), and carried unanimously.

STATUTORY MEETING.

The Secretary then read the notice convening the first ordinary general statutory meeting, which accordingly took place.

The Chairman said: Gentlemen, this is our first general statutory meeting, and, as is usual on such occasions, we have not much to communicate to you. Up to the present time our business has been chiefly the organisation and preparation for the work which is doubtless before us, and which we hope to carry on on a very extensive scale when the winter brings us long dark nights and often dark days. The company was incorporated on May 15th with a capital of £1,000,000 sterling, in 200,000 shares, of which 100,000 shares were first offered. 392,686 shares, or very nearly four times the number offered, were applied for, and the whole number available—100,000—were in the first instance allotted. This number was reduced by 310 withdrawals, which, after full and careful consideration, the directors were constrained to admit upon legal grounds. We engaged suitable, but not extravagant, offices at 110, Cannon Street. One of your first directors, Major Wood, resigned his seat at the board, finding that very onerous calls upon his time in other directions rendered him unable to give that attention to our affairs which their importance necessitated. But the board was strengthened by the accession of Mr. Rose, of the firm of Morton, Rose, and Co., a gentleman well known to you all by reputation at least. We entered into a working arrangement with the Hammond Company, under which we secured the services of Mr. Hammond as our managing director on terms based upon a share of the profits. Mr. Hammond had before gathered together a considerable staff, and had explored,

so to speak, the requirements of the metropolis as regards electric lighting. He had also established a lighting station at Westminster and another in Holborn. Mr. Hammond's reputation as an energetic man of business and a successful organiser of the Brush system must be very well known to you all. We felt that in making this temporary arrangement we did the best in our power to provide for a successful starting of our operations. We appointed Mr. Wilson, a gentleman who has had great experience in public companies, to be our secretary. As soon as our organisation had been completed, we proceeded to lay the foundation of the extensive business which we trust is before us. We advertised in all the newspapers; we gave a wide circulation to the pamphlet prepared by our managing director, giving prices of plant and machinery, estimated cost of installations, &c. Up to the present time our work has been confined mainly to small private installations. As regards public lighting, although we have been in communication with many authorities, we have found that on their part they have an objection to make any movement till the Electric Lighting Bill has become law. All those gentlemen who are concerned in electric lighting must have followed the course of the bill with a considerable amount of interest, though perhaps also with a little apprehension. I was prepared to address you in somewhat different terms to those I shall now have to adopt, for I am happy to inform you that in Committee of the House of Lords on Tuesday the bill underwent considerable and material modification. The terms for which licences can be granted with the assent of the local bodies was altered from five to seven years, and the period for which provisional orders can be granted from fifteen to twenty-one years. This is no doubt a considerable concession. But the objectionable clause of the bill is a compulsory sale clause which still remains in it in the inequitable terms, if I may so express myself, in which it was first drafted; and it is to this point we shall have to direct our future efforts. Under this clause, as you are well aware, electric light undertakers are liable to be compelled to sell their plant and property at the end of the period for which a provisional order has been granted for the mere price of the materials, without taking into consideration anything regarding the goodwill of the concern. This I consider very bad. But it might have been justified to some extent had there not been in the bill a clause which regulates the price at which electricity shall be supplied to consumers. The existence of this clause restrains electric undertakers from making large profits, while the sale clause compels them to sell their property at a time when in all probability they had begun to reap the fruits of their enterprise. As regards our action under the bill we have matured the steps that we shall adopt and which we intend to take as soon as possible. It would not be advisable for me to make any detailed statement of what those steps are. All that I can tell you is that we have arranged what shall be done, and to lose no time in doing it. It is very encouraging, gentlemen, to find that there is a general and growing opinion that the electric light enterprise has before it a great and immediate future. Wherever the subject is discussed, whether it be in Parliament or out of Parliament, or in the columns of the public press, the sentiment is almost universally expressed. In an article in the *Times*, of the 17th July—I don't know whether you have all seen it—there are words to the effect that, "there is a vast field of electric work, and so far from having to educate the public to the use of electricity, as some seem to contemplate, those who are concerned in its distribution will soon be applied to by more customers than they can deal with." This, gentlemen, has up to the present time been our own experience. We have joined also in a very important movement. You are aware that there are many companies who derive their licences, as we do, from the Anglo-American Brush Corporation. We have thought it advisable to join a conference of those companies, their boards having agreed to send delegates to form a council. Our licences are similar but our districts entirely distinct. We have a common cause and no conflicting interests. We therefore thought that for united action and protection of common interests, a council of that description would have a very important effect in protecting the Brush interests. Already the council has met and arranged its procedure, passed important resolutions as regards the quality and price of plant and material, which it receives from the Anglo-American Brush Corporation. These, gentlemen, are all the remarks I have to make, and if any gentleman has any questions to ask I shall be glad to answer them to the best of my ability.

Mr. Campbell asked whether the 310 which were withdrawn were subscribers or shares?

The Chairman replied that they were shares, not subscribers.

A shareholder asked if the company were doing any business at the present time?

The Chairman said they were doing business in many directions.

The shareholder, continuing, said they held meetings occasionally, but he thought they heard nothing definite.

The Chairman answered that they were preparing to do business when business arose. They were doing business to a very considerable extent, and he might mention from memory, Covent Garden.

Another shareholder: You are earning money at the present time?

The Chairman: Yes, sir.

Mr. Price said he thought many of the shareholders were dissatisfied, and he should like to ask a question or two. The Camberwell Streets Committee asked for tenders to light with electricity the streets in their district. Only one tender was sent in. Was it theirs? And if not, why did they not tender? Did they possess the right to manufacture their own carbons, or were they manufactured in New York and sent over here? As there seemed to be a doubt as to whether electric lighting could compete with gas in regard to price, he should like to ask whether the last tender would be remunerative for lighting certain districts in the City? Were the lighting of certain railway stations in the metropolis remunerative contracts? He should be very pleased with a plain answer.

The Chairman thought that all those questions could be very easily answered. As his friend, Mr. Hammond, was more acquainted with the practical details of those matters, he would ask him to reply.

Mr. Hammond said, as the gentleman before the previous speaker had asked a question which involved a great principle in the business of the company, he might be pardoned if he dealt with it as well as the chairman. An electric lighting company, in its initial stage, had a great deal of ground to cover in the way of preparing for business, and if they got no fruits from them they would certainly be in a great mess. One was also anxious not to be too closely questioned as to the mode of organisation they had pursued in the metropolis, though he should like to make them as enthusiastic as he was himself as to what was being done in a quiet manner to cover the whole place. If he were to take them into the office and show them the streets all named, the traveller of each put to them, and the days upon which they visited these districts, they would form some idea of how the districts were being covered. They did not want to tell their friends outside all they were doing; but he could assure them there was no spot in the metropolis that was not being covered by this company. That preliminary work was being carried out with as little expense as possible, and they felt that where £1 was spent in this manner they would get back £3 in its place. Their time up to the present had by no means been lost. In the matter of grouping together districts, and the hiring out of lights, it was their policy to get the customers first and then put down central stations in the midst of them. He felt that amongst friends he must ask their forebearance, because he could not say too much. He could not, however, sit there and hear a hint that they were spending money to no purpose. That was not so. With regard to the Electric Lighting Bill, he might say they did not like it. However, they were glad to see that the Lords amended the compulsory purchase clause from fifteen to twenty-one years. For his own part he was now satisfied with the bill as a preliminary piece of legislation in this line, and he hoped that by next year it would be considerably improved in their favour. Personally he felt that the bill should go on, rather than that they should block it. There was a certain work connected with the bill which would prove of immense value to this company. They were conscious of that, and he said no more. The one tender sent in to the Camberwell vestry was that sent by this company. That tender, if it had been accepted, would have formed the basis of the systematic lighting of Camberwell, which would have left a considerable profit to this company. He would be the last man in the room to dodge the question asked, but he must say that if they were to have to put down gas mains merely to light a certain place, and were not allowed to light places *en route*, it would be done at a great loss. Gas companies put down a main, and said to themselves "we shall have the lighting *en route*," and they put the price down; otherwise the price per 1,000 feet would be 21s., or five times the ordinary charge. What was asked for with regard to the gas question, they asked for the electric light. They said: "get this light and you will get that." They based their price upon what would be remunerative when the whole thing was a going concern and in fair working order. If they did not adopt that principle, they would ask such prices that the vesteries would not listen to them. He was careful to put in that tender that the company would only do the lighting on condition of having the lighting *en route*, and after one year. They would not give the company the lighting *en route* after one year. Everything with regard to that tender was considered from the point of view of the interests of the company. With regard to carbons, he was glad to tell them that the company had every power to get their carbons in the cheapest market, but they were bound to the Brush Company for their machine and lamp; although, as a matter-of-fact, they found it convenient, considering the organisation the Brush works had, and the apparatus they had, to go to them for materials; yet in carbons they were perfectly free. As a matter-of-fact, at the moment, they went to the Anglo-American for their carbons; this company had an arrangement with them whereby they could buy on cheaper terms than they could get them from anybody else. He believed it was true that the Anglo-American Company got their carbons from America, in doing so they got them under very special terms with the patentees there, who had the right to make them in that particular manner. He could assure the shareholders that the directors kept a serious eye upon that question. The man who got the lighting generally got the order for the trimmings required afterwards. If they were to light the hotel in which they were assembled, which was quite within the bounds of possibility, they would probably get all orders for trimmings, carbons, &c., afterwards. He could dispose of the third question by saying that this company did not tender for lighting in the City, but that would only be a technical way of meeting the question. The City tenders were closed the day before this company had its capital subscribed, and it was therefore impossible for the company to tender. A tender was put in on behalf of the Hammond Company, and an arrangement was made between that company and this that they should have a mutual benefit. He had really answered the question as to the remunerative part of this undertaking in his answer concerning Camberwell. The undertaking would have left a profit if they could do the lighting by their mains *en route*. With regard to certain other lighting in the City, with one exception, the railway companies, after a trial of the plant, have paid for it, so that no question of yearly profit arose, except the profit which arose from supplying carbons. The Great Eastern Railway Company tried the light, and finding it worked satisfactorily, gave a cheque for the amount. The only station which was not in that position was Charing Cross, and in that case the parent Brush Company was running that station for the cost of the gas bill, in order, primarily, thoroughly to show what its system could do. They were running it under such favourable circumstances that they felt themselves recouped by the gas bill; for instead of having to put up a separate installation they were running it from their works at

Lambeth, a thing which was only possible with the Brush system. When they went to Lambeth and saw the whole lighting done from one machine, through five miles of wire, and when they went to look at an opponent's system, which required for the same amount of lighting thirteen dynamo machines and eighteen wires, then they saw that the Brush was ahead at the moment of every other system, and would, they hoped, remain so. The position at Charing Cross was simply turning the power, which otherwise would drive a lathe, on to a dynamo machine.

In reply to a question, Mr. Hammond said that the lighting of Charing Cross and the City was the only piece of Brush lighting not done by the Metropolitan Company.

The Chairman, in answer to a question as to the concession received by this company from the Hammond Company, stated that the Hammond Company had received a concession for the City of Westminster, and they had also a lighting station at Holborn; and it was in order to extinguish these rights that an arrangement was entered into with the Hammond Company.

Dr. Rosenthal said he should like to ask what was the position of the company with regard to satisfying the want of an independent secondary battery, or accumulator; for he felt that in future an accumulator would be quite as important an element in their work as the dynamo machine.

The Chairman replied that the consideration of an independent accumulator was engaging the very earnest consideration of the board. There were the Faure, Sellon-Volckmar, and other accumulators in the field, but the policy of the directors with regard to this matter had been one of waiting, because they were not quite satisfied with the efficiency of those accumulators. They had very good hopes and expectations that the results which had hitherto been obtained from the accumulators now considered the best, would be excelled by others; and they had therefore felt disinclined to pledge their capital in that which was good now, but which was likely to be superseded by something better.

Mr. Bigg said he should like to ask a question or two. He had understood that 390,000 shares had been applied for, and 100,000 were allotted, and 310 were withdrawn. Was the £3 paid upon the remaining 100,000? Did the directors of this company themselves take a large interest in the undertaking?—for that would inspire the shareholders with a great deal of confidence—or did they simply take their qualification? What prospect was there of their making a further call? He found that their shares could be obtained at 1¾ discount, and he thought any further call would be ruinous to their finances.

Mr. James Whitehead replied, with the chairman's permission. He said that out of the total sum called up, of £300,000, there only remained £3,645 unpaid. And while he was on his feet, he should like to reply perhaps more fully, if Mr. Hammond would excuse him, to the question put by a gentleman in the body of the meeting, with reference to the price of electricity, as compared with gas, in the City. He did not know whether all those who had considered the question had fully taken into account the very large extra amount of light given to the public by the electric system. For the sake of argument, they would compare themselves with the gas burners, according to the improved system, with an extra consumption of gas, and the effect of that would show that in the four districts for which this company tendered through the Hammond Company, in the City, the cost of gas would be £7,250, which was more than double their tender for electric lighting—for their tender was for £3,725, allowing £725 for wear and tear. With reference to the Electric Bill, they had felt that the compulsory sale clause was not only unfair to this company but to all electric lighting companies. He did not want to depreciate the value of their property, but he thought if they could get the present bill altered so that they could get a fair chance against gas, then they would be able to make this company a successful undertaking, not only so far as electric lighting of the metropolis was concerned, but also financially. He wanted the shareholders to realise what were the difficulties under which they laboured with reference to the compulsory sale clause as it stood at present. They paid £235,000 for the exclusive right to use the Brush and Lane-Fox patents in the metropolitan area. If, for the sake of argument, they spent another £265,000 in plant, making the £500,000 of issued capital, and if at the expiration of twenty-one years their property was to be taken for the simple value of the machinery, they would see that the £500,000 must be provided for before the expiration of the time when it might be taken over by the local authorities. That was a very serious business. If they said for the sake of argument—of course all this in the present state of things was highly hypothetical—after the expenditure of £265,000 in plant, they had to provide for a total of £473,500 to liquidate the amount expended before the expiration of the twenty-one years, during which they had exclusive right of using these patents in the metropolitan area, and if they assumed that during the twenty-one years they had fifteen years of good work, and divided that sum by fifteen, they would find that they had £31,566 to provide for yearly, besides the usual amount for repairs and wear and tear. He wanted to show them the necessity of putting their shoulders to the wheel in order that they might obtain fair, and equitable and just, rights to enable them to compete against the gas companies already in the field. He thought this was a question which concerned not only the shareholders of that company, but concerned seriously the interest of the general public throughout the entire kingdom. Very few of them would contest the point for one moment that the electric light was not superior in every respect to gas; it was not only more brilliant but it did not affect colours by night; it gave exactly the same light at night for the judging of colours, and in consequence was of great benefit to trades in the kingdom, especially in drapery; but it was also a more healthy and wholesome light, and did not injure their pictures or curtains.

In reply to a further question from Mr. Bigg,

The Chairman said he was not in a position to state what was the interest of the directors in the company. The register was open to the inspection of any gentleman who chose to look at it. He believed the directors had a substantial stake and interest in the concern. As regarded the question in reference to a call, he might say there was no intention to make a call, and no call would be made until the progress of the business was sufficiently advanced to justify it. He hoped, however, they would have occasion to make a call speedily, but they would not do so until they had a good use for the money.

Mr. Hammond said, that in order that his previous remarks might not be misapprehended, or that he might not be thought to differ from his colleagues, he should like to add that he was only satisfied with the Electric Lighting Bill as an instalment of legislation in this matter. He should like to read one clause from which he took a grain of comfort; and he hoped that grain would extend to a tree, under whose branches they might eventually rest contented:—"Thereupon such undertakers shall sell to them their undertaking, or so much of the same as is within such jurisdiction, upon terms of paying the then value of all lands, buildings, works, materials, and plant of such undertakers." "The fair market value" was mentioned. They were not to have quite "old iron price," as one noble lord put it, for there was to be taken into account in the sale a great deal of work, of labour involved in laying down mains, &c., which was so much an element that it should be included in the fair market value of the concern. He was quite willing to note the words which had been pointed out to him: "Without any addition of compulsory purchase, or of good-will, or of any profits which may or might have been or made from the undertaking." He did not think that the two conflicted, but it was well that the shareholders should know that there were two views in Parliament in regard to the bill. He was anxious that all doubts in the matter should be removed by next year.

Dr. Pocock asked whether this company would exhibit at the approaching gas and electric exhibition at the Crystal Palace. It seemed to him that the public mind wanted a great deal of education in the matter of electricity, and he should quite approve of their making experiments to show that they had something good to offer.

The Chairman, in reply, said he thought that if any steps were taken to exhibit, the proper persons to do so would be the parent Brush company—the Anglo-American Company. He was glad to find that the shareholders were with the board in the matter of experiments.

A vote of thanks to the chairman, proposed by Mr. T. R. Denny, and seconded by Dr. Rosenthal, closed the proceedings.

BRUSH ELECTRIC LIGHT AND POWER COMPANY OF SCOTLAND (LIMITED).

THE first general meeting of the above-named company took place at Cannon Street Hotel, on Wednesday afternoon. In the unavoidable absence of Lord Crawford, Chairman, the Hon. Ashley Ponsonby, Vice-Chairman, presided.

Mr. F. M. Brockelbank, Secretary, having read the notice convening the meeting,

The Chairman said: Gentlemen, I have not very much to say. We meet to-day for the statutory meeting in conformity with the regulations of Parliament. I am very glad we have had the opportunity of meeting, because there may be many questions asked which we shall be happy to answer to the best of our ability. I may tell you that the Brush Electric Light Company of Scotland was incorporated on the 25th April, and the issue was made to the public on the 27th April this year. The capital was £300,000 in 60,000 shares of £5 each, of which the first issue was £150,000. 8,000 shares were reserved in part payment for the concession by the vendors, and the remainder was offered to the public. We never had, I suppose, in such a company so large a subscription. You will see, then, when I tell you that we had 22,000 shares to offer to the public. We had subscriptions for these representing 373,553, so that you can see the difficulty of allotment. I believe there was some little feeling of irritation that we did not allot quite satisfactorily, but I assure you we did not know what to do in view of the enormous number of applications. We had 2,677 shareholders, which is rather large in so small a company. Now, gentlemen, you may congratulate yourselves on another fact, that you have your settlement and your quotation on the Stock Exchange. I believe many other of the companies who came out have only one or neither of these, which will show you that in our case everything was done to the approval of the Stock Exchange committee, everything was above board, and satisfactory—a matter very pleasing to the shareholders. The secretary reminds me that I have said we have now 2,000 shareholders on the list, there were 2,677 applicants, and now we have 400 or 500 shareholders. I made a mistake by taking the number of applicants as shareholders. We have no intention of issuing additional capital at present, but of course that question will depend on the work we get in Scotland. We are getting applications for tenders for our work daily, and I hope very shortly to be able to show you a very good report of what work is doing and is to be done. You must remember we have been delayed very much in our action by the law proceedings in Scotland, with regard to the liquidation of the old company that is now perfectly finished, so our solicitor tells me. We could not undertake the election of officers or the beginning of work, or of tenders of any sort or kind until we were perfectly sure that we had everything in shape. As you will see in the book now in your hands, we have appointed as our chief electrician and manager in Scotland Mr. Beckingsale, of whom we have the highest testimonials; and we have appointed also Mr. Brockelbank as our secretary; and Mr. Wylie our agent in Edinburgh; and we have another gentleman, Mr. Martin, in Dundee. These are most energetic and urgent in pushing forward the business, and the board of directors are perfectly satisfied with the working of the company in Scotland. Scotland, you may remember, has an advantage over many other places from its abounding in water power. Water

power exists in nearly all large private houses and factories, and this is of immense importance, because when you have the water power you reduce the cost of the electric light to a minimum; whereas, if you have steam power only, you have to add an expense which does not always contrast favourably with gas lighting. Therefore I always look on Scotland as best adapted for the electric light; hence the good field we have. I shall be very happy to answer any questions, as it is not my intention to delay you long.

Mr. J. Walker: Have you done any work in Glasgow, Edinburgh, or Dundee?

The Chairman: We have at the Waverley Station, Edinburgh.

Mr. Walker: It is some time since the company was started. I thought you would have pushed forward more quickly than you have done. Will you explain what is meant by liquidating the old company? It is the first time I have heard of any old company.

The Chairman: We are lighting the Waverley Station, that is, the central station in Edinburgh. We have tenders out for the lighting of the Tay Bridge Station and others for the East Station in Dundee. We have now mills sending up for tenders, and hope shortly to be able to do business in that direction. The Scotch people are very careful; they don't like to jump in the dark. They like the light before they jump.

Mr. Walker: Is it a profitable contract you have, do you think?

The Chairman: We believe it to be so. The Chairman then read from the prospectus the contracts that had been made with the Scottish Brush Electric Light Company, the company who sold their rights to the present company.

Mr. Walker: Has there been any difficulty between the two companies?

The Chairman: Not between us. I do not intend to enter into other people's business. There was a disagreement between that company and the Anglo-American, who are partial vendors to us. They disputed the appointment of a liquidator, and occasioned application to the courts of law, causing considerable delay to us; but there is no hostile feeling with us.

Mr. Walker: Has it entailed any cost to this company?

The Chairman: The solicitor will tell you. I believe nothing at all. They only sold to us, as vendors.

Mr. Walker: I think this should have been mentioned in the prospectus.

The Chairman: I have just read the prospectus.

Mr. Walker: Oh, I had not seen it. Is the price stated?

The Chairman: Yes, in the agreement. It was £15,000 cash and £40,000 fully paid-up shares. It is the similarity of names that has caused a great deal of confusion. People have been wanting to know if we were winding-up, and all sorts of things.

Another Shareholder: I believe the answer just received from you, Mr. Chairman, with regard to the working, is not altogether satisfactory. You started in May. You have done nothing yet beyond the lighting up of stations. You say you are going to do a great deal, but why is not more done? Then, I must say, we have received a very fair statement, but we expected more to be done. The liquidation of the old company ought not to interfere with the progress of our business. The difficulty was simply with regard to the transfer of money received by them from us. I am sorry to see we gave £55,000 for our patents; this amount, if you consider the merits of the system, is an excessive price. You stated in your prospectus that the object of the company was for the purpose of lighting up public streets, public buildings, and private houses. Now, sir, so far as I understand, you are not in a position to light up private houses, that is, you are not able to compete with gas, for the simple reason that you do not possess all that is necessary to compete with other systems, your system being, of course, incomplete. I refer more especially to a very important thing, that is a secondary battery or accumulator. Is that included in the Brush system? I do not believe it is, and without it you cannot complete the lighting of private houses. It is a matter of impossibility, if I can rely upon the opinion of those who ought to know. The speaker said he had been alluding to a speech of Lord Crawford at a recent meeting of the Oriental Storage Company (cries of "Question"). When you said the object of this company was to light up streets and private houses, of course I understood by your system you would be able to do it. Now, such a statement is misleading, and you mislead me for one to subscribe to the company. I would not have subscribed had I known the system was incomplete; and I believe this is the explanation of the shares being at a discount. Then I believe that the majority of the directors of electric light companies are too fond of blaming the purchase-clause of the new Act. Now, sir, I do not believe but that that clause will be amended at some future time; but, of course, it is better—(cries of "Question")—than to be without a Bill at all. Yet I would like to know are all the shares allotted? Have the directors a substantial interest in this company beyond that required to qualify for director (hear, hear).

Mr. Dickson rose, at the request of the chairman, to answer the last speakers. He said: From the time the company was incorporated and the shares allotted, we had of course to face the difficulty mentioned through the liquidation of the old company; and although it has been said that we ought to have gone and plunged into work rapidly, I think that as prudent men we were justified in waiting a little until we saw how those disputes between the Scottish and Anglo-American Brush Company were settled. We had nothing to do but to look out for the shareholders' money, and we would not part with it until the lawyer satisfied us. It would never have done to plunge into work finding we had a lot of lawyers tied to our necks; it would not have been satisfactory at all. With regard to the second question asked, it was known that we were taking over the concession of the other company in Scotland, who had been working before us. We had to see our shareholders well protected. The gentleman who spoke second said we had paid a large sum for concessions—£55,000. But we have not paid that. And I take it that if you will add all the concessions made, the negotiations prove our company not to have got the worst bargains ever obtained. For £15,000 cash we got clear of preliminary expenses, such as advertisements, lawyer's charges, and brokerage. In that direction a great deal of money often is spent. The rest of the £55,000 was paid in shares, and the bulk of the shareholders' money is therefore still in the bank intact. In the third place, as to our going into work. Now, we all know that in the height of summer it is not the time when people rush into light; it is when the dark nights come in that people become sensible that they would like something better than gas. Across the border people are very careful in these matters. When we floated our company, the Crystal Palace show and exhibition was being held. People naturally said, "We will not go in for this till we see which is the best." At the Crystal Palace we were asked to show the Brush system, and I believe Scotch people went away satisfied that that system was the best. But we did not push the business until we saw our way a little clearer. Waverley Station, the lighting of which we have undertaken, is one of the most important in the country. If we do that thoroughly, all the tourists that go south and go north will see it, and we shall thus get a good advertisement. To show you, too, that the North British Company are quite aware of whom they are dealing with, they only had sixteen arc lights last year, and they have now given us an order for double that number. We are carrying that order out with an efficient staff and proper instruments, so that the sort of slipshod way in which it was done before will not recur in the management of your board of directors. Having obtained that position at Waverley, I consider we have got the gate of Edinburgh.

Mr. Walker: Is the order for a term of years or for a series of years?

Mr. Dickson: We have made the bargain as well as we could for several years. Of course you cannot get the railway companies to do as you will. There, the same as here, they make a compact, and say, "We will see that satisfactorily carried out for a certain number of years first."

Mr. Walker: And they can continue or discontinue the light altogether, I suppose?

Mr. Dickson: I think we are all friends here; but there are numbers of competitors watching us in Scotland, and it would not be judicious to tell you all that I could tell you here. I think the directors are doing their very best, and we do not wish to say too much to benefit our critics in the north. In obtaining the lighting of the Waverley Station, with our powerful engine we have ability to light up Princes Street, and a good deal more. We have drafts and estimates for Inverness, and for Dundee and Arbroath Stations. We have estimates for Tay Bridge, and are going into them. If we can only sufficiently see our way to save ourselves from loss and get an advertisement for our centre, and from that centre light other places near, I think we can see our way to a good business. We were told by the previous speaker that we cannot compete with gas, but I say we shall soon be put in the same position as the gas companies. Take Princes Street or Cheapside and say to a gas company, "Will you light up this street, and tell us the cost?" For twenty lamps perhaps you will have to pay twenty-one shillings per 1,000 feet. Your next neighbour perhaps only pays a few shillings, but there it is inside the houses. When we get inside the houses I trust the electric light will be as successful as the most far-seeing people expect In regard to the Oriental Storage Company, it has been stated that they having the storage batteries, were in a position to do more than we have done. But they have to pay for it, and I cannot see that in the present initial stage of batteries it is right to rush in and buy up anything that can be got (hear, hear). We have reserved our opinion and our money and are ready to take advantage of the best storage battery we can get. We have the money and I hope the brains to make a bargain, and when once we get inside the houses, we shall be able to do a business. No one who has read the evidence given before the parliamentary committee can have the slightest doubt about that (hear). I may say in touching upon these storage batteries that we have been in treaty for a number of months past for the best one standing in the market, and which I understand comprehends all the five best patents known, and it is the same as the Storage Company have. I think we have done no harm whatever by the delay. As regards what was said about the noble chairman, I am sorry he is not present. He takes an earnest interest in our company's welfare, and there is no one who, as an amateur, knows more of electricity than he does. When he went to the House of Lords, on the day when the Electric Lighting Bill was amended, he went there thoroughly determined to have—what had never been attempted by any one else—those two objectionable clauses altered, No. 2 and No. 7; and I may say that, both to his personal position in the House of Lords, and to the influence he brought to bear on his colleagues there, there is in a great measure due the fact that we have seven years instead of five for licences, and twenty-one instead of fifteen for provisional orders. That will allow us to feel about and see what we are doing, so that when the twenty-one years are over we may not be called upon, as we should at the fifteen, to sell our articles as old metal. I hope when Parliament meets next Session the two clauses now reading in opposition to each other will be put right, thus showing us where we stand. I think, meanwhile, the Bill as we have it is a good one to go on with, and the fact that we have not gone on more rapidly already is to be attributed to our not having the Bill. We could not do it, and had better let our money be at the bank at interest (hear, hear). Now we have the ability to take up streets instead of going and hanging wires overhead, making the most extraordinary state of things everywhere. We have now a bill which I think will do us very well for the present, and I believe your directors have the interests of our shareholders at heart; and I take it there is no place for our business like Scotland, where we can get such cheap coal, and if we can only make a central station as I have explained, we can produce the light, I think, very much cheaper than it can be produced here. The item of coal is one of great

importance in regard to the working of the engines and the machinery at all the factories. With water power available at every castle in the North, every mill wheel at the end of the village, if we use our centres well and do not expect too much, we have, I think, a fair prospect of doing as good business as have most things which are brought before us.

In reply to a further question from Mr. Walker, in regard to the selling of concessions.

Mr. Dickson explained that there was no use in their acting differently from what they had. Broker after broker came asking for concessions, but to have granted them would simply have been to prostitute their position. The matter of the sale of concessions they had still before them.

Mr. Wm. Ladd said that although unaccustomed to speak in public, he felt he would like to say a few words to give them confidence in the property in which they had invested their money. He was an old electrican, and one of the pioneers of the electric light, therefore he flattered himself that he knew something of the different machines and different systems at present in vogue. The Brush machine he believed, in considering all the other systems, was very far in advance of every other for large lighting, he meant for extensive districts. There was no machine that could send a current so far as the Brush machine. There was no other machine that could give them 40 lights in one circuit. There was no other machine to compare with it for economy; he said economy, and he meant it. If they wanted one or two lights there were other machines that would compare with it, but if they wanted to light streets, or houses, there was no other machine in existence that would take so many lights; and although the price of the machine might appear to be somewhat high, yet the price of the machine was far below any other when they came to lighting a town or a large number of streets. Forty lights from one machine meant two wires, or rather one wire, going through the whole of those 40 lights and back to the machine; whereas in other systems, what you require for large lighting, you require a machine for each lamp, and that meant a great expense—more than was apparent at first sight, because they needed separate wires for each light and back again. From those lights on the Embankment, for instance, he believed that the Brush system would have given a better light and a greater light for the cost of what it had cost them for wires. Scotland was a splendid district for the light because of the water power that could be utilised. What must tell somewhat against Scotland, however, was that the Scotch people were scarcely educated up to the advantages of the electric light, and they had to educate them as yet. What he was anxious to do was to light up Glasgow, or some large place like that. Put out all the lights in the streets, and let the Scotchmen see what this company had got. There was nothing said in the prospectus with regard to accumulators. The gentleman who spoke just now would seem to say that he had been imposed upon by the prospectus. The gentleman ought to have made himself acquainted with all the ins and outs of the company. If he did not understand it, he ought not to blame any one else. It was unfortunate for the directors that there was such a rush for shares in this company; it gave them a great deal of work and caused a great deal of dissatisfaction amongst the public. Not a single director, he might say, appropriated more than one hundred shares to himself, although some applied for five hundred. They reduced their number in consequence of the number applied for. He hoped they would go on and prosper; and he was glad they had not sold concessions. He did not say they would not sell concessions, but the reaction that had come upon electric light now was affecting this company in the price of its shares, which was always the case when there was a great cry for anything.

A Voice: They are worth 17s. 6d. now.

Another Shareholder asked if any one could take the Brush system away from this company. Was it certainly theirs?

Mr. Ladd: Most decidedly, so far as Scotland is concerned. Mr. Ladd added that there was one thing he had forgotten to mention, and that was with reference to accumulators. He was a director of the Electric Light and Power Company, which had the entire lighting of the United Kingdom, and he should do all in his power for the benefit of this company; and if it could be arranged satisfactorily he was sure he would do all in his power in the matter. The Brush machine was adapted for the storage batteries, because they could have a machine in one district and send a charge along the whole street, and charge the storage batteries for the lighting of the houses.

Another Shareholder: Are you in negotiation for the use of the Sellon-Volckmar accumulator? Are the vendors allowed to dispose of their 8,000 shares?

The Chairman: The same as in any other company.

The Shareholder: With regard to the shares I hold, I should like to say I applied for shares when there were none to be had, and I bought those which I hold, so that the remarks made by Mr. Ladd are not fair. I had the prospectus before me.

Mr. Dickson said there were many accumulators before them, and he must decline to answer the question. The board were considering their merits, and he thought the shareholders had better let the question alone.

In reply to another question the chairman said that applications for shares were so large that they were obliged to cut down every one.

Mr. Dickson added that all the Brush companies had joined a conference, meeting monthly, to discuss the interests of the Brush patents, and they had taken issue on certain points. They had agreed on many points, by which they had obtained considerable concessions, and they were an earnest of what was to come. They were watching in earnest upon these matters, and pulling together with a will, so as to keep themselves well in front of their opponents everywhere.

Mr. Walker, who remarked that he was doubly unfortunate, for he bought some of his shares at a premium of between £2 and £3, and they were now worth 17s. 6d., proposed a vote of thanks to the chairman for presiding and the satisfactory manner in which he had answered the questions, which was seconded by Mr. Newton, and the proceedings terminated.

THE ELECTRIC CARBON, STORAGE, AND APPARATUS MANUFACTURING COMPANY OF SCOTLAND (LIMITED).

On Wednesday last, under the presidency of Mr. W. P. Hope, of Leith, the chairman of the company, the statutory meeting of the shareholders of the above-named company was held at Cannon Street Hotel.

The notice convening the meeting having been read by the secretary, Mr. Ernest Terreneau,

The Chairman said: You have heard the notice convening the meeting. It pretty well explains the cause of this meeting. It is simply a statutory meeting, to fall in with the law of limited liability companies, and, finding myself in the chair in the absence of Mr. Ratcliff, I have to explain that we have got possession of the premises at Leith, and we have been busy getting the necessary tools placed in those premises, and are now partially manufacturing carbons, in the hope of being able to begin manufacturing dynamo lamps within a few weeks of this time. We have 171 shareholders upon our list, holding 28,117 shares. The applications for shares—this company coming out late, when the electric *furore* was at its height—were smaller than were anticipated, but were sufficient to warrant the directors in going forward to allotment, especially as they had an offer for the sale of the storage shares which form part of the property to be handed over to this company at a price which induced them to part with them at once. Having made arrangements of settlement of property satisfactory to themselves, and having capital available for any extension of business, the board thought it wise to go on to allotment, and go forward with small capital, watching the event of electricity, and watching the future of it, believing we have a great deal yet to learn, believing we have a great deal we don't know to-day that we shall know in a month or two hence. We have no expensive patents, and no sums of money due for any system; we are simply waiting with a well organised system to take advantage of the time when the best electric machine will be before the company, and then to go forward. So far as we have gone in the direction of carbons, we have succeeded in producing an article which is as good as any yet before the public. Our prospects are very assuring. We have proposals from the continent and from various parts of this country for the manufacture of plant, when we are in a position to take it up. The demand for electric appliances such as we aim at producing, which is a good yet cheap article, will, we believe, be very encouraging to the public. We are going in to encourage the public in cheap electric appliances, and I believe in a very short time we shall have quite as much work as we can do. Many of the companies which have come before the public lately have savoured more of the kind which the Stock Exchange have more interest in than the company I am speaking of. A Stock Exchange quotation we do not intend to move for, seeing that our capital is insufficient. Those who invested money in this company will, with a little patience, find that something better than stock which may be bought and sold at the prices of the day. Owing to the delay in placing our machinery we have to-day to point more to what we intend to do rather than to what we have done. I hope next time we meet you that we shall have something more tangible to lay before you. We have some of our carbons here (on the table), which are at the disposition of the shareholders.

Dr. Rosenthal: I should like to ask whether any orders have been received already.

The Chairman: I think I explained in my opening remarks that we are only now in a position to receive orders, in consequence of delay in fixing our machinery.

Dr. Rosenthal asked if, when the money had been paid to the vendors, whether there would be enough capital to carry on the manufacturing.

The Chairman: I am glad to be able to give you that information, although I did state it in what I said before. I said that the directors were satisfied with the arrangements they had made with the vendors to forego their payment for a while, that they now had enough capital to carry on business, and to meet any increase of work for the next twelve months. We have already promises of work for several companies when we are ready to supply them; not exactly their orders, but promises to supply them with what they may require.

No further questions being asked, Mr. J. D. Fraser proposed a vote of thanks to the chairman, which concluded the proceedings.

Telegrams for Egypt.—It is officially announced that the Eastern Telegraph Company has established cable communication with Port Said, and telegrams for that place can be accepted, but at the sender's risk only. The charges are 2s. a word.

Cables Repaired.—Notice is given that the cable of the Paris and New York Telegraph Company, and the cable between Rio Grande do Sul and Monte Video, are repaired.

Brush Midland Electric Light and Power Company, Limited.—Mr. James Whitehead (chairman) and Mr. Augustus A. Stenger have resigned their seats at the board of this company.

Quotations have been granted to the Australasian Electric Light, Power and Storage Company, shares; the British Insulite Company, Limited, shares; and Swan United Electric Light Company, shares.